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NOTES ON THE HOST PLANTS AND PARASITES OF SOME NORTH AMERICAN BRUCHIDÆ[1]

By R. A. CUSHMAN, *Bureau of Entomology, Washington, D. C.*

For the past four years the author has been closely connected with the work on the parasites of the cotton boll weevil. In connection with this work hundreds of lots of plant material of various kinds, infested by other weevils and bruchids have been collected and sent in to the laboratory of the investigation at Dallas, Texas. In the following pages the information collected on the latter group, as to both the host plants of the various species and their parasites, is brought together. A few other records obtained elsewhere are also included. This group of beetles, at least in breeding habits, approaching closely many of the weevils, attracts many of the parasitic enemies of that group. A number of the most important of the parasites of the boll weevil have been found to attack bruchids, and for this reason many lots of infested material were collected and placed in breeding cages and the issuing parasites recorded.

All but two of the bruchid species discussed here breed in the pods of leguminous plants. Plants of this sort are especially abundant and varied in the southern and western portions of Texas, forming a considerable part of a very characteristic flora. In this section of the state most of the leguminous plants are "chapparals" (shrubs or small trees), and occur over wide areas. Their pods furnish the breeding places of many species of this and other groups of insects. In several instances the same lot of pods was found to be infested by two species of *Bruchus*. In the more humid portions of the state and in the neighboring states to the north and east, the "chapparals"

[1] Published by permission of Dr. L. O. Howard, Chief of the Bureau of Entomology.

are largely replaced by a number of smaller legumes, which also support quite a series of bruchid species. In addition to these two classes of legumes, there are a number of trees, as the locusts and redbud, which also have their typical bruchid enemies.

The particular interest of the men employed in the work was with the parasites, and observations on the hosts were necessarily limited. But as opportunity offered observations were made and recorded.

At least eight of the species of parasites reared from bruchids are known to attack the boll weevil. Of these *Cerambycobius cyaniceps* Ashm. is, on account of its wide geographical and host range, by far the most important. It has been definitely reared from at least seven species of bruchids ranging from New Mexico to the District of Columbia, and from many other hosts in stems, fruits and buds, as well as from the boll weevil throughout the range of that species in the United States. Of the latter host it is everywhere an important enemy, becoming in some regions, notably southern Arkansas and northern Louisiana, the dominant parasite. The bruchids have undoubtedly been among the principal sources from which the boll weevil has drawn its quota of this parasite. In fact, the nature of the bruchid fauna, or rather, of the bruchid flora of the region mentioned might well account largely for the dominance of this parasite as an enemy of the boll weevil. As has already been stated, the leguminous flora of southern Texas is largely small trees or shrubs, or in other words, perennials. Their fruit is to a considerable extent indehiscent, and affords constant opportunity for the breeding of bruchids. Thus we find that a number of bruchids breed almost constantly in the pods of such plants as the huisache (*Vachellia farnesiana*) and mesquite (*Prosopis glandulosa*). This furnishes the normal bruchid parasites with an abundance of preferred hosts, and such species as *C. cyaniceps* do not become so noticeable as parasites of the boll weevil. On the other hand, the leguminous flora of the Arkansas-Louisiana region is largely annual and the fruit dehiscent. This prevents the development of more than two generations of bruchids in a year, one maturing in the late summer and the other hibernating in pods prevented from opening by the presence of the immature bruchids. This leaves nearly the whole summer in which the parasites must either not breed or must seek other hosts. The boll weevil, being the most abundant suitable host, draws to itself many of these parasites, especially those, such as *C. cyaniceps*, which are least particular as to the nature of their host. An exactly similar case exists in eastern Louisiana, where another chalcid, *Catolaccus hunteri* Cwfd., is the dominant parasite of the boll weevil. This parasite is the species most abundantly bred from the dehiscent pods of *Acuan illinoensis*, an annual legume,

attacked by *B. compressicornis* Schaef. This plant is one of the most abundant weeds along ditchbanks, headlands, and other waste lands throughout the region.

In regions where the parasites have constant access to their natural hosts, they only occasionally leave these to attack another insect. However, if, through some catastrophe, they are deprived of their normal hosts, they search for and oviposit in other suitable hosts. An instance of this catastrophic transfer of parasites from their normal host to another was furnished in the summer of 1907 at Victoria, Texas. During that season the huisache trees over a large area produced almost no pods, the normal breeding place of *Bruchus sallæi* Shp., due to the activities of a small weevil (*Tychius* sp.), which breeds in the flowers. A remarkable increase in the percentage of parasitism of the boll weevil was traced to this occurrence by the breeding from infested cotton squares of large numbers of *Cerambycobius cushmani* Cwfd., normally parasitic on *B. sallæi*.

Of the other parasites known to attack both the boll weevil and bruchids, the species of *Eurytoma* have not been determined; *Lariophagus texanus* Cwfd., though attacking certain of the bruchids abundantly, has but seldom been recorded from the boll weevil; *Bracon mellitor* Ashm., *Microdontomerus anthonomi* Cwfd., and *Habrocytus piercei* Cwfd., all normally weevil parasites, have been only occasionally reared from bruchids.

Certain of the parasites seem to be confined to the bruchids as hosts. In this class are *Urosigalphus bruchi* Cwfd., *Glyptocolastes bruchivorus* Cwfd., *Heterospilus bruchi* Vier., and *H. prosopidis* Vier. The species of *Horismenus*, which have not been determined, are even more closely restricted, some being apparently confined to a single host species.

If the author seems to have ignored the practice of the European authors of giving the family name of this group of beetles as Lariidæ instead of Bruchidæ, and of dividing the genus *Bruchus*, he must plead a lack of the systematic knowledge of the group necessary for placing the different species in their proper genera. To this circumstance also must be attributed the lack of any attempt at a logical arrangement of the species considered. The information given is simply contributed as an addition to the biological knowledge of the group.

The thanks of the writer are due and are herewith extended to Mr. Charles Schaeffer, who determined most of the Bruchidæ, and to Messrs. J. C. Crawford and H. L. Viereck, who determined the parasites.

Bruchus julianus Horn, Proc. Cal. Acad. Sci., Ser. 2, V, p. 410.

This species, the largest of the genus in the United States, was

recorded by Schaeffer (1904) as occurring quite commonly in July on *Acacia flexicaulis* (=*Siderocarpus flexicaule*), with the comment that it undoubtedly breeds in the seed pods of this tree. Specimens in the collection of the National Museum at Washington were reared from the same plant, the so-called Texas ebony. A large series of specimens have been reared by us from three lots of the *Siderocarpus* pods.

The first lot of material was collected by Mr. H. P. Atwater at Corpus Christi, Texas, in November, 1903. Mr. J. D. Mitchell subsequently found it at Harlingen, Texas, August 1, 1906. From this lot the first adults emerged on August 16, and the last on September 11, giving, from the date of collection, a minimum of fifteen and a maximum of forty-one days.

The third lot of pods was collected by Mr. Mitchell at Victoria, Texas, on July 26, 1907. The first adult emerged July 31 and the last recorded on August 18. However, two months later, on October 18, the pods were examined and six living adults found still in the seeds. This gives a maximum period in the seed of at least eighty-four days. The species is apparently single brooded.

From all three of the lots of material many specimens of *Horismenus* sp. were reared. This species is internally parasitic on the larval *Bruchus*, leaving the body of its host and pupating in the cell. Many individuals mature on a single host. Some of the records on this point are as follows, one larva serving as the host of the number of *Horismenus* given in each case: 10, 30, 33, 33, 34, 56, 64. In two cases two parasitized larvae were found in the same seed and the parasites counted together. One pair produced 53 parasites and the other 132. This is the only parasite we have reared from this *Bruchus*.

Bruchus ochreolineatus Fall, Trans. Am. Ent. Soc. XXXVI, No. 2, 1910, p. 186.

This large species was found by the author breeding in the large, distorted pods of a "chapparal" (probably *Mimosa fragrans*) in the Chisos Mountains, Brewster County, Texas, in June, 1908, and in September at Ballinger and Albany, Texas.

In the Brewster County material it was parasitized by *Glyptocolastes bruchivorus* Cwfd., and an undetermined chalcid.

Bruchus quadridentatus Schaeffer, Mus. Brooklyn Inst. Arts and Sci., Science Bul., Vol. 1, No. 10, 1907, p. 304–305.

About forty specimens of what appear to be this species were reared from pods of a plant called by the Mexicans "Tenaza." The author has been unable to ascertain the scientific name of the plant. It is, however, one of the many "chapparals" growing in the semiarid

portion of South Texas. The only lot of material we have had was collected by Mr. J. D. Mitchell at Brownsville, Texas, on November 20, 1907. No exact data were kept by Mr. Mitchell, but the forty adults were recorded as having emerged between January 30 and March 19, 1908.

Between January 30 and August 11, 1908, thirty-five parasites emerged. By far the most abundant was *Urosigalphus bruchi* Cwfd., of which twenty-five specimens were reared. Six of the others were *Heterospilus bruchi* Vier., one *Phanerotoma* sp., two *Glyptocolastes bruchivorus* Cwfd. and the remaining one *Parasierola distinguenda* Kieff.

Among the breeding records of the Department of Agriculture is one referring to this species. Unfortunately the host plant is not given, but two species of parasites were reared. These were a single male specimen of a *Cerambycobius* and two specimens of *Glyptocolastes bruchivorus* Cwfd. The material was collected and reared February 1, 1911, at Brownsville, Texas, by D. K. McMillan.

Bruchus quadrimaculatus Fabricius, Syst. El., II, p. 398.

This species has been repeatedly observed by the writer and other members of the boll weevil laboratory force heavily infesting its normal host, the cowpea. At the laboratory in Dallas, Texas, it was found heavily parasitized by two undetermined chalcids.

It was frequently found visiting the nectaries of cotton plants in the yard.

Chittenden (Yearbook U. S. Dept. Agr., 1898, p. 247.) recorded *Bruchobius laticeps*[2] Ashm. and *Aplastomorpha prattii* Ashm. MS. as attacking this species. The predaceous mite *Pediculoides ventricosus* Newp. is also recorded by him as killing large numbers of the various stages of this *Bruchus* and of *B. chinensis* L.

Bruchus mimus Say, Curc. N. A., p. 2; Leconte Ed., I, p. 260.

On September 12, 1907, Mr. W. D. Pierce found the pods of redbud (*Cercis canadensis*) to have been infested, presumably by a bruchid. The only trace of the insect found were the emergence holes and the "exuviæ of a *Cerambycobius* female and of another parasite." On October 18, 1907 the writer collected a large lot of these pods, from which emerged many specimens of *B. mimus* and its parasites.

The species is a continuous breeder, reproducing on the old pods even within a darkened cage. Thus specimens were emerging as late as October, 1908, from pods of the previous season.

The following species of parasites were reared from this host: *Cerambycobius cyaniceps* Ashm., *Horismenus* sp., and *Glyptocolastes*

[2] Recorded as *B. laticollis* Ashm. which is an erroneous spelling of *B. laticeps* Ashm.

bruchivorus Cwfd. The last is represented by a single female specimen, found dead in the cell of its host in a seed. The *Horismenus* is, so far as is known, peculiar to this host. It breeds singly as a primary parasite. Both *Horismenus* and *Cerambycobius* hibernate within the pods of Cercis in the immature condition, specimens of the former having emerged in our cages as late as March 30 and of the latter March 5.

Bruchus discoideus Say, Journ. Acad., Ser. 1, Vol. III, p. 307.

Three males and one female of this species, sent me by Mr. R. W. Dawson, Lincoln, Neb., are labeled "Working on *Ipomoea leptophylla*, Glen, Sioux Co., Neb., 4000 ft."

Bruchus bivulneratus Horn, Trans. Am. Ent. Soc., 1873, p. 325.

This species, recorded by Riley and Howard (Ins. Life, V, 165) as breeding in the pods of *Cassia marilandica*, was found by the writer at Alexandria, La., in the pods of an undetermined plant (probably *Cassia* sp.) These pods were collected on March 17, 1908, and were of the preceding season's crop. Examination of some of the material disclosed fourteen individuals, ten adults, one teneral adult, and three pupæ, From the pods examined four individuals had already emerged. From another lot of pods collected at the same spot in the following January, no adults had emerged at the time of collection, and the first one did not appear until March 8. The last to emerge from this lot appeared March 22, and the latest adult from the first lot emerged on March 31. The species is, at least on this host plant, single brooded and hibernates in the immature condition. The place of collection of this material at Alexandria is the only locality in which the host plant has ever been found by the writer, and *B. bivulneratus* has been but rarely collected by us in the field. This indicates that it is probably confined in its attack to this plant.

Our records include only one parasite of this species. This is *Horismenus* sp., which breeds singly as a primary parasite. Like its host it hibernates in the pods in the immature condition, probably as a pupa, since all individuals observed in material examined were in this stage. But one specimen was reared from the first lot of pods. This became adult on April 4. From the second lot six specimens were reared, the first on February 6 and the last two on March 22.

Bruchus ulkei Horn, Trans. Am. Ent. Soc., 1873, p. 324.

A single specimen of this species sent me by Mr. R. W. Dawson, Lincoln, Neb., was bred from *Parkinsonia aculeata*, September 9, 1910, from the campus of the University of Arizona.

Bruchus sallæi Sharp, Biol. Cent. Amer., V, p. 475.

This species was of especial interest on account of its being the host of many of the parasites of the boll weevil. Consequently many lots

of infested material were collected and large numbers of the insect and its parasites reared.

Its breeding habit was first found by the author on April 22, 1907, at Victoria, Texas, when a few of the previous season's pods of the huisache (*Vachellia farnesiana*), were found infested by it.[3] At this time the new crop of pods, which were still soft and green, were not infested. The first of the brood in the new pods was reared June 17, 1907, from material collected June 13, at Victoria. A few individuals had already emerged when the collection was made. The pods are first attacked at about the time when they begin to turn dark, and the species is a continuous breeder, carrying on its reproduction, even in the confinement of the breeding cages, as long as there is suitable food. In the field this continues until the new crop of pods has reached the proper stage for infestation.

The egg, which is deposited on the surface of the pod, is oblong oval in shape, .75 mm. long and about half as wide. It is covered with a thin varnish-like substance, which spreads out somewhat beyond the boundary of the egg and fastens it securely to the pod. The larva emerges from the side attached to the pod and burrows in to the seed.

In one large lot of huisache pods this species was accompanied by *B. amicus* Horn.

What proved to be the immature stages of a small variety of *B. sallæi*, as determined by Mr. Charles Schaeffer, were found April 19, 1907, by the author at Corpus Christi, Texas, in the pods of the black chapparal, *Acacia amentacea*. It was associated on this host plant with *Apion subornatum*, the latter species feeding on the substance of the pod and not in the seeds, as is the habit of the *Bruchus*, it is very unlikely that these pods produce more than one generation of the *Bruchus*, as they split open when ripe and scatter their seeds, while the huisache pod is indehiscent.

Six full-grown larvæ of this small form were isolated in small vials on May 15, 1907. On May 22 four had cast the pupal skin, three having already emerged and the other being still soft. This gives a maximum pupal period of eight days.

A single specimen of *B. sallæi* was found by Mr. J. D. Mitchell in a seed of *Gleditsia triacanthos* near Victoria, Texas, on October 9, 1907, its presence there being probably due to the fact that its normal food-plant, huisache, produced almost no fruit during that season in the neighborhood.

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[3] Pierce (Journ. Econ. Ent., I, p. 391) has mentioned this species as "*Laria* sp. in *Vachellia*," basing his record on the rearings at the Boll Weevil Laboratory.

Many parasites of this species were reared from the various lots of huisache pods. These include *Urosigalphus bruchi* Cwfd., *Glyptocolastes bruchivorus* Cwfd., *Heterospilus prosopidis* Vier., *Lariophagus texanus* Cwfd., *Cerambycobius cyaniceps* Ashm., *Cerambycobius cushmani* Cwfd., *Cerambycobius bruchivorus* Cwfd., *Eurytoma* (two or more species undetermined), *Catolaccus* sp., *Horismenus* sp., *Microbracon* sp., an undetermined Eupelmid, *Parasierola distinguenda* Kieff., *Cephalonomia hyalinipennis* Ashm., and from one lot many specimens of a very minute chalcid, the last possibly secondary.

Pierce (1908b) has already recorded some of the above records, mentioning the following species as parasitic on "*Laria* sp. in *Vachellia*" (=*B. sallæi*): *Eurytoma tylodermatis* Ashm.,[4] *Cerambycobius cyaniceps* Ashm., *C. cushmani* Cwfd., *C. bruchivorus* Cwfd., and *Urosigalphus bruchi* Cwfd.

Several of the parasitic species were described from specimens reared from this host. This is true of *Glyptocolastes bruchivorus*, *Lariophagus texanus*, and *Cerambycobius bruchivorus*.

Some of these parasites, notably *Urosigalphus*, *Cerambycobius cyaniceps*, *C. cushmani*, and *Horismenus*, repeatedly attacked the *Bruchus* in the pods in the confinement of small breeding cages, so that several generations of parasites were reared under this unnatural condition. A female *Horismenus* was observed by Mr. Pierce to thrust her ovipositor into each end of an empty *Bruchus* egg-shell, evidently trying to locate the hole by which the larva entered the pod. *Urosigalphus*, *Cerambycobius*, *Heterospilus*, and *Lariophagus* have been repeatedly observed running about over the pods searching for places to oviposit. In one lot of pods collected April 22, 1907, *Lariophagus* was still emerging on July 5; in another lot collected June 24, 1907, *Horismenus* was still emerging on July 25 and *Urosigalphus* as late as August 14; in a third lot collected August 10, 1907, there were bred on September 20 four *Glyptocolastes bruchivorus*, three *Cerambycobius cushmani*, three *Urosigalphus bruchi*, one *Catolaccus* sp., and two *Lariophagus texanus;* and in a fourth lot, collected September 6, 1907, there were bred on September 21 one *Cerambycobius cushmani*, four *C. cyaniceps*, six braconids (undetermined, either *Glyptocolastes texanus* or *Heterospilus prosopidis*), three *Catolaccus* and one *Urosigalphus*. The last lot was allowed to remain in the cage over winter, with the result that from March 14 to March 18 six specimens of *Urosigalphus*, five of *Horismenus*, and four of *B. sallæi* emerged.

[4] *Eurytoma tylodermatis* Ashm. as used by Pierce throughout his paper, "A List of Parasites Known to Attack American Rhynchophora," probably includes more than one species.

There is no doubt but that the parasites hibernated in the pods in the immature condition.

The only lot of pods collected early in the spring, before the new crop had become infested, produced the following species of parasites, which had undoubtedly hibernated in the pods: *Urosigalphus*, *Glyptocolastes*, *Lariophagus*, *Horismenus*, and a bethylid.

Horismenus sp., breeds very abundantly as a primary parasite, ten or more maturing on a single host. This *Bruchus* is its only known host. *Urosigalphus bruchi* is the most abundant parasite of *B. sallæi*, while *Heterospilus prosopidis*, *Glyptocolastes bruchivorus*, *Cerambycobius cyaniceps*, *C. cushmani*, and *Lariophagus texanus* were reared in considerable numbers, all as primary parasites. The others were rare or occasional. All of the parasites except *Horismenus* and probably *Lariophagus* and the minute chalcid breed singly.

Bruchus prosopis Leconte, Proc. Acad. Nat. Sci. Phil., X, 1858, p. 79.

This species was reported by Leconte (loc. cit.) as abundant in the pods of mesquite, *Prosopis juliflora* (=*glandulosa*) and the screw bean, *Strombocarpus*, in the Colorado Desert and by Riley and Howard (Ins. Life, V, 165) as bred from the pods of Prosopis. Several other authors have since recorded it from the same host plants. Our records include only *Prosopis*. In Texas it is almost always accompanied by *B. amicus* Horn. One female specimen of this species, received from Mr. R. W. Dawson, Lincoln, Neb., was taken on *Prosopis velutina* at Oro Blanco, Ariz., August 17, 1910.

The only parasite we have reared from this species is *Urosigalphus bruchi* Cwfd. However, two other species have been recorded as probably parasitic on it. *Heterospilus prosopidis* Vier. was described from specimens bred from "*Bruchus* in *Prosopis juliflora*," and *Glyptocolastes texanus* (Ashm.) Cwfd. was described from specimens "bred from *Prosopis juliflora*, where it was probably parasitic on *Bruchus prosopis*." All of the above species are primary parasites and breed singly.

In addition to the above records notes in the files of the Department of Agriculture record the breeding of the following parasites from this species: *Urosigalphus bruchi* Cwfd., one specimen bred from *Prosopis juliflora*, infested by *B. prosopis* and *B. amicus*, at Kingsville, Texas, June 21, 1909, by D. K. McMillan; many specimens of *Heterospilus prosopidis* Vier., four specimens of an undetermined chalcid, and three of an undetermined proctotrypid with the same data as the *Urosigalphus; Heterospilus prosopidis* Vier., three specimens, bred from *B. prosopis* at Brownsville, Texas, June 17, 1908, by D. K. McMillan.

Bruchus amicus Horn, Trans. Am. Ent. Soc., 1873, p. 337.

This species is recorded by Riley and Howard (Ins. Life, V, 165) as breeding in the pods of *Parkinsonia torreyana* and *P. microphylla*. It breeds abundantly in company with *B. prosopis* in mesquite beans (*Prosopis glandulosa*). We have also bred it on one occasion in large numbers in company with *B. sallæi* from pods of huisache. (*Vachellia farnesiana*) from Victoria, Texas. Four specimens, received from Mr. R. W. Dawson, Lincoln, Neb., were taken on *Prosopis velutina* at Oro Blanco, Ariz., August 17, 1910.

No parasites have been definitely reared from this species in our cages, but it is undoubtedly attacked by the typical parasites of other species of *Bruchus* in the same host plants.

Horismenus productus Ashm. was described from specimens reared by C. H. T. Townsend from *B. amicus* at Las Cruces, N. M. Townsend (Can. Ent., XXVII, 1895, p. 277) records this species and also *Eupelmus* (= *Cerambycobius*) *cyaniceps* Ashm. as reared from *B. amicus*.

Bruchus cruentatus Horn, Trans. Am. Ent. Soc., 1873, p. 325.

This species was recorded by Riley and Howard (Ins. Life, V, 165) as breeding in the pods of *Parkinsonia*. We have reared it from pods of *Cassia chamæcrista*, collected in September at Dallas, Texas, by Mr. W. D. Pierce. At this time all four stages were found. No parasites were reared.

Bruchus sp.

This is a small reddish species with abundant gray pubescence. It was found at Marfa, Texas, on June 5, 1908, by Mr. J. D. Mitchell and the author attacking the peculiar bladder-like pods of an *Astragalus* (near *triflorus*). The adults continued to emerge until June 27.

In this lot of material over 70 per cent of the insects were parasitized, the species concerned being *Eurytoma* sp. (undetermined) and an undetermined chalcid, probably a new species, both of which breed singly as primary parasites.

Bruchus placidus Horn, Trans. Am. Ent. Soc., 1873, p. 341.

The pods of two low leguminous plants, probably species of *Astragalus*, were found on September 23, 1908, at Lampasas, Texas, by the writer to have been abundantly infested by this species. On that date, however, most of the insects had emerged, although one specimen bred from each species of plant served to identify the author of the damage. Of these two belated individuals one was found in the pods at the time of collection and the other emerged on October 5. No parasites were reared.

Bruchus limbatus Horn, Trans. Am. Ent. Soc., 1873, p. 326.

A single specimen of this species was reared from a lot of "Tenaza"

pods collected November 20, 1907, at Brownsville, Texas, by Mr. J. D. Mitchell, in company with many specimens of *B. quadridentatus* Schaef.

Several specimens were recently received at the Department of Agriculture from Mr. M. M. High. These were reared by Mr. High from "Ebony" at Brownsville, Texas, March 6, 1911. The "Ebony" is undoubtedly *Siderocarpus flexicaule*.

Bruchus obtectus Say, Curc. N. A., p. 1; Leconte Ed., I, p. 261.

Very little attention was given to this species, only one lot of infested material having been collected. This was part of a sack of badly riddled red kidney beans found by the author in a wholesale grocery house at Shreveport, La. No parasites were secured from this lot.

Chittenden (Yearbook U. S. Dept. Agr., 1898, p. 242) recorded *Cerambycobius cyaniceps* Ashm. and *Bruchobius laticollis*[5] Ashm. as valuable parasites of this species.

Bruchus schrankiæ Horn, Trans. Am. Ent. Soc., 1873, p. 339.

This species, originally described by Horn from *Schrankia uncinata*, was reared from one lot of the pods of a species of "cat-claw" (*Mimosa borealis*) collected May 4, 1907, at Devil's River, Texas, by Mr. F. C. Bishopp. It was associated on this plant with *Apion pyriforme* Sm. On May 4, 1907, a single specimen was bred by the author from a pod of "black chapparal," *Acacia amentacea*, in company with *B. sallæi* and *Apion subornatum*. From the *Mimosa* the first adults emerged May 17, and the last June 8, giving a maximum of thirty-five days and a minimum of thirteen days from the date of collection. No parasites of this species were reared.

Bruchus distinguendus Horn, Trans. Am. Ent. Soc., 1873, p. 336.

This species was mentioned by Blatchley in his "Coleoptera of Indiana" as being reared from *Bracca virginiana*. Our only breeding record was secured by the author on January 10, 1907, at Nacogdoches, Texas, where a few pods of *Rhynchosia latifolia* were found containing the immature stages. A weevil, the adult of which was never secured, also breeds in these pods. Eight adult *B. distinguendus* were reared from the small amount of material obtained, the first two on July 29 and the last three on August 2. This gives minimum and maximum periods from the date of collection of nineteen and twenty-three days respectively. This is probably considerably short of the developmental period, as all the larvæ observed were well grown at the time of collection.

A chalcid of the genus *Chalcis* or a closely allied genus was bred from the material, but its source could not be determined. It was,

[5] Wrong name for *B. laticeps* Ashm.

however, probably parasitic on a lepidopterous larva, the adult of which was not reared.

Bruchus exiguus Horn, Trans. Am. Ent. Soc., 1873, p. 341.

Riley and Howard (Ins. Life, V, 165) record the breeding of this species from *Amorpha fruticosa* in Illinois and Washington, D. C. The writer has found it infesting the seed pods of this plant in a number of localities in Texas and Oklahoma. It is a continuous breeder and specimens can be found in the pods at any season of the year. Our notes are based on material collected by the author at Dallas, Albany, Henrietta, and Bowie, Texas and Ada, Oklahoma, and by Mr. J. A. Hyslop at Washington, D. C.

Every lot of material which was kept over winter in the cages continued to give forth adults well along into the following spring. The first lot obtained was collected at Dallas, Texas, on September 12, 1907. It consisted entirely of the crop of the preceding season, but was abundantly infested. Adults continued to issue from these pods as late as October 10, when the material was thrown away. At the time of collection the *Amorpha* bushes were in bloom, so that the last adults reared emerged nearly a year after the first infestation.

This species is attacked by a number of hymenopterous parasites, the following having emerged in our breeding cages: *Horismenus* sp., *Cerambycobius cyaniceps* Ashm., *Heterospilus prosopidis* Vier., *Glyptocolastes bruchivorus* Cwfd., *Eurytoma* sp., *Microdontomerus anthonomi* Cwfd., *Cerambycobius brevicaudus* Cwfd., *Catolaccus incertus* Ashm., and an undetermined Eupelmid, the female of which is wingless. The first five of these were bred abundantly. Of *C. brevicaudus* only three specimens were reared, of *M. anthonomi* only two, and of the Eupelmid only one pair, which were in copula when removed from the breeding cage.

Three of the species are known as parasites of the boll weevil: *C. cyaniceps*, *M. anthonomi*, and *Eurytoma* sp.

Cerambycobius brevicaudus Cwfd. was described from specimens reared from this host and is known only as a parasite of this host. This is also the only known host of the *Horismenus*.

The four principal parasites were reared from the material almost continuously, many individuals hibernating in the pods in the cages. All of the parasites reared breed singly as primary parasites of the *Bruchus*.

Some of the above records of parasites were published by Pierce (1908b). The species mentioned by him as attacking *B. exiguus* are *Microdontomerus anthonomi* Cwfd., *Cerambycobius brevicaudus* Cwfd.,

C. cyaniceps Ashm., *Catolaccus incertus* Ashm., and *Eurytoma tylodermatis* Ashm.[6]

In addition to the above parasites *Meraporus bruchivorus* Ashm. was described (Bul. Ohio Expt. Sta., Tech. Ser. I, No. 3, p. 161) from specimens reared from this host.

Bruchus ochraceus Schaeffer, Mus. Brooklyn Inst. Arts & Sci., Science Bul., Vol. I, No. 10, 1907, p. 303.

This species was found by the writer at Alexandria and Forbing, La., and Victoria, Texas, infesting the two-seeded pods of a small species of *Vicia* (near *hirsuta*). The first collection was made at Alexandria on September 14, 1907. At this time most of the pods were still soft and green, and none of the insects had emerged, but examination of some of the pods disclosed adults ready for emergence. This condition at such a late date, together with the fact that the pods scatter their seeds when ripe, would seem to indicate that the species is at most double brooded. That certain individuals of the second generation hibernate in the pods was shown by the fact that a very few pods collected at Alexandria on January 24, 1909, which had not opened, gave forth later one specimen of *Bruchus* and a number of parasites. Also, from nearly every lot collected early in the fall, specimens of both the *Bruchus* and its parasites were reared during the following spring. This indicates a second generation, within the breeding cage, of the parasites as well as of the host. The pod is prevented from opening when infested by a full-grown larva or a pupa by reason of the seed being securely fastened to the valves by the larva. The latest date of emergence of this species in the spring was February 12. This specimen, however, emerged from a lot of pods, which was kept in a vial indoors, and is probably somewhat earlier than the normal type of emergence under natural conditions.

The parasite species reared from this host were as follows: *Heterospilus prosopidis* Vier., *Microbracon* sp. *Cerambycobius cyaniceps* Ashm., *C. cushmani* Cwfd., and *Eurytoma* sp. All of these breed singly as primary parasites. The first mentioned is the most abundant, while *C. cushmani* was reared only from the Victoria material. This latter species has, in fact, been reared from any host in only one locality outside of South Texas. This was at Alexandria, La., where a few individuals were reared from the boll weevil, and where a careful, but unsuccessful, search was made by the writer for the native hosts of the parasite. The finding of the breeding habit of *B. ochraceus* was one of the results of this search, the two lots of *Vicia* pods secured at that time having been collected at the edges of the two cotton fields from which *C. cushmani* had been reared. Of *Microbracon* sp. only

[6] See footnote p. 496.

one specimen was reared. Its large size renders its parasitism on the *Bruchus* somewhat doubtful. It was probably parasitic on some other insect, possibly a lepidopteron, the adult of which was not reared.

The latest date for the rearing of *Heterospilus* from this host was April 21, for *C. cyaniceps* March 6, while *C. cushmani* emerged in December.

Bruchus compressicornis Schaeffer, Mus. Brooklyn Inst. Arts. & Sci., Science Bul., Vol. I, No. 10, 1907, p. 305.

Bruchus bisignatus Horn, Trans. Am. Ent. Soc., 1873, p. 334.

These two species are considered together for the reason that, though the former is frequently found alone, the latter has never, in our experience, been reared except in company with *B. compressicornis*, and a consideration of the parasites must include both species.

B. compressicornis was found by the writer breeding in the flat, clustered pods of *Acuan illinoensis* on September 18, 1907, at Forbing, La., and in the following summer at Victoria, Texas. We have also reared it from the same plant at Tallulah and other points in eastern Louisiana. From the Victoria lot several specimens of *B. bisignatus* were reared and from the Tallulah material one specimen of this species. Mr. D. K. McMillan found both species breeding abundantly in *Acuan* at El Reno, Okla., in August, 1909.

The first record of the breeding of *B. bisignatus* was published in Insect Life, Vol. V, p. 286, where it is recorded as breeding in the pods of *Desmanthus virgatus* from Mexico. *Acuan illinoensis* was formerly known as *Desmanthus brachylobius*, and the specimens reared by Mr. McMillan are so labelled.

From the material from Forbing, La., which was infested only by *B. compressicornis* and which was very highly parasitized, no adults of the host were reared until the following May 16, from which time they continued to emerge until June 20. The pods infested by this species are prevented from opening in the same manner as the *Vicia* pods are kept closed by *B. ochraceus*.

The very high percentage of parasitism in this lot (97 per cent, based on the recorded rearings) was due entirely to two species: *Heterospilus prosopidis* Vier. and *Cerambycobius cyaniceps* Ashm., both primary parasites. The former was much the more abundant, 107 individuals of this species being reared and 17 of the *Cerambycobius*. *Heterospilus* continued to emerge from the pods of this lot as late as June 20 and *Cerambycobius* until March 7.

The parasites reared at Tallulah, La., were all chalcids. The most abundant species was *Catolaccus hunteri* Cwfd. This was reared in large numbers. One specimen of *Habrocytus piercei* Cwfd. and three of *Cerambycobius cyaniceps* Ashm. were also reared. *Catolaccus*

continued to emerge from one lot of pods of the previous season as late as April 13 and from another until April 27. In both of these lots *B. compressicornis* emerged for some time after June 6. No observations were made from that date until August 30, when the cages were cleaned out and many dead *Bruchus* found.

From the material collected at El Reno, Okla., infested by both species of *Bruchus*, Mr. McMillan reared nineteen specimens of *Heterospilus prosopidis* and seven specimens of an undetermined chalcid. These parasites undoubtedly attack either species of *Bruchus*.

Cœnophanes n. sp. (probably a species of *Heterospilus*) is recorded in Insect Life (loc. cit.) as reared from *B. bisignatus*.

A few specimens of *B. bisignatus* emerged unexpectedly from the material collected at Victoria, Texas, for breeding the parasites of *B. compressicornis*. No parasites were, however, bred from this lot.

Bruchus hibisci Olivier, Ent. IV, p. 21, No. 28, pl. 3, fig. 28a–b.

This is the only species of the genus that we have found which does not attack a leguminous plant. Throughout Louisiana, especially in the low, swampy regions, it is the most commonly collected bruchid. The adults are found visiting a great variety of flowering plants. During the blooming and fruiting season of *Hibiscus*, its host plant, it is very abundant within the involucres. The writer has found as many as twenty-five or thirty adults in the involucre of a single bloom, and they may be reared in very large numbers from the infested capsules or "bolls." In the "bolls" it is sometimes associated with *Conotrachelus fissunguis* Lec.

It is recorded in Insect Life, V, 165 as "bred from seeds of *Hibiscus moscheutos* at Bluffton, S. C., and Washington, D. C.; also from seed of *H.* sp. (*militaris?*) at St. Louis, Mo." The species found to be attacked by it in the writer's experience is *H. militaris*. Among the records in the Department of Agriculture is one referring to this species as being bred from the capsules of *Abutilon abutilon* at Washington, D. C., July 30, 1906, by F. H. Chittenden.[7]

Our notes on this species are based on rearings from three lots of the pods of *H. militaris*. These were collected at Mitchener and Newellton, La., and Eudora, Ark. From the Newellton lot the adults continued to emerge until October 9 and from the Eudora lot until October 14. The earliest record of emergence was in the Mitchener lot, July 31. Unlike most of the members of this family the larva does not seem to prepare an opening through the seed coat, from which

[7] During the present summer (1911) the writer has found the adults and eggs of *B. hibisci* abundant on *Abutilon* at Vienna, Va. The egg is white, about .5 mm. long by about one third as wide, and oblong oval in shape. It is deposited among the pubescence of the *Abutilon* capsule. As has been discovered with other species of the genus, the newly hatched larva has long delicate legs, which are later lost.

to emerge, since when the seeds of the last mentioned lot were examined on July 16, no external evidence of infestation was found.

From the Mitchener lot of material many specimens of *Conotrachelus fissunguis* were reared.

Spermophagus robiniæ Fabricius, Syst. El. II, 1801, p. 397.

We have reared this species from the pods of the honey locust (*Gleditsia triacanthos*) in Texas and Louisiana and of the water locust (*G. aquatica*) in Louisiana. The description of the species by Fabricius gives the host plant as *Robinia pseudacacia*. This is probably an erroneous determination. Our earliest collection of pods of *G. triacanthos* was made on August 15, 1907, at Forbing, La. From this lot the adults began emerging on August 28. Of *G. aquatica* pods, the first lot was collected on September 19, 1907, at the same locality. At this time larvæ, pupæ, and adults were found, but no emergence had taken place. From late summer until well along in the spring specimens can be bred from the pods of either species of locust, our latest record being March 22, 1909, when one adult emerged in a lot of *G. aquatica* pods collected at Shreveport, La., on January 25.

This species is sometimes abundantly parasitized. From it we have reared the following species, all primary: *Heterospilus bruchi* Vier., *Urosigalphus bruchi* Cwfd., *Eurytoma* sp., *Horismenus* sp., *Microbracon* sp., and *Cerambycobius cyaniceps* Ashm. Heterospilus is much the most abundant of these. All of the parasite species mentioned hibernate in the locust pods, probably in the immature condition.

Pierce (1908 b) has already recorded some of the above parasites as attacking *S. robiniæ: U. bruchi*, *C. cyaniceps*, and *Eurytoma tylodermatis* Ashm.

Wickham (1895) found the larvæ in honey-locust in October heavily parasitized by *Cœnophanes spermophagi* Ashm. MS., four or five individuals maturing on a single host. He also reared *Horismenus* (*Holcopelte*) *popenœi* Ashm., and records it as probably secondary through *Cœnophanes*.

Caryoborus arthriticus Fabricius, Syst. El. II, p. 398.

Charles Dury (Can. Ent. XIII, 1881, p. 20) recorded this species as breeding in the seeds of palmetto (genus *Sabal*). In 1893 it was again recorded by Riley and Howard (Ins. Life, V, 166) from the same plant. Mr. J. D. Mitchell found it attacking a member of this genus near Brownsville, Texas, in 1907. The adults emerged the following spring, the last appearing on May 30.

Some of the adults deposited eggs on the surface of the seeds. These are opaque white, about one millimeter long, and oval in shape. They are attached to the seed by a small patch of a shellac-like substance.

The fruit of the small palmetto which grows abundantly throughout the swampy regions of Louisiana was found to be infested by this species at Tallulah, La. The only lot of material was collected January 2, 1910, by Mr. V. I. Safro. A note made by him is as follows: "In emerging from the berries the Bruchid makes a clean, circular cut in the surface of the berry, pushes this 'lid' off, and emerges. The hole thus formed is about three-sixteenths of an inch in diameter. It extends almost to the opposite side of the berry.

In order to bring the present knowledge of the host-plants and parasites of the North American species of Bruchidæ together the following brief statement is given. The numbers and letters in parentheses refer to the bibliography following. Asterisks indicate records obtained by the "Boll Weevil Investigation" and other records published for the first time in the present paper.

TABLE OF HOSTS AND PARASITES OF BRUCHIDÆ

Species	Host-plants	Parasites
Caryoborus arthriticus Fab.	Palmetto (*Sabal*) seeds. (16c, 7,*)	
Spermophagus robiniæ Fab.	Gleditsia triacanthos. (16c, 4, etc.,*)	Heterospilus bruchi Vier. (*)
	G. aquatica. (*)	Cænophanes spermophagi Ashm. MS. (22)
	Robinia pseudacacia. (3) (? *)	Urosigalphus bruchi. Cwfd. (14b*)
	"Black and honey locust." (3)	Microbracon sp. (*)
		Cerambycobius cyaniceps Ashm. (14b*)
		Eurytoma tylodermatis Ashm. (14b)
		E. sp. (*)
		Horismenus popenœi Ashm. probably secondary through Cænophanes spermophagi. (23)
		Horismenus sp. (*)
S. pectoralis Shp.	Beans. (5c)	
[= Zabrotes. (5c)]	Cowpeas. (5c)	
	Mexican beans. (18b)	
S. vitis Schaeff.	"Taken only on grape vines." (18b)	
Bruchus alboscutellatus Horn.	Ludwigia alternifolia. (16c, 10)	Bruchophagus mexicanus Ashm. (1c, 21a)
	L. palustris. (3)	
	Glycyrrhiza lepidota. (21a)	
B. amicus Horn.	Parkinsonia torreyana. (16c)	Cerambycobius cyaniceps Ashm. (21a)
	P. microphylla. (16c)	Horismenus productus Ashm. (1a, 21a)
	Prosopis glandulosa. (21b,*)	"Probably attacked by parasites of *prosopis* and *saller*." (*)
	P. pubescens. (21a)	
	P. velutina. (*)	
	Vachellia farnesiana. (*)	
B. aureolus Horn. (smaller form.)	"On flowers of Astragalus sp." (11a)	
B. bisignatus Horn.	Desmanthus virgatus. (16d)	Cænophanes n. sp. (16d)
	Acuan illinoensis. (*)	[= Heterospilus. (14b)]
		"Probably same parasites as *compressicornis*." (*)
B. bivulneratus Horn.	Cassia marilandica. (16c)	Horismenus sp. (*)
	Cassia (?) sp. (*)	
B. chinensis L.	Beans. (16b, 16c)	"Two or more chalcidid parasites." (5b, 5c)
[= Pachymerus. (5f)]	Chinese beans. (16c)	
	Table beans. (5c)	
	Cowpeas. (5c, 5d, 5f)	

TABLE OF HOSTS AND PARASITES OF BRUCHIDÆ—*Continued*

Species	Host-plants	Parasites
B. chinensis L. (*continued*)	Phaseolus radiatus. (5c)	
	Cajanus indica. (5c)	
	Cicer arietinum. (5c)	
	"Kolu." (5c)	
	"Muneta." (5c)	
B. compactus Shp.	?Ipomœa sp. (16c)	
B. compressicornis Schæff.	Acuan illinoensis. (*)	Heterospilus prosopidis Vier. (22b see footnote 1,*)
		Cerambycobius cyaniceps Ashm. (*)
		Catolaccus hunteri Cwfd. (*)
		Habrocytus piercei Cwfd. (*)
		Undetermined chalcid. (*)
B. cruentatus Horn.	Parkinsonia. (16c)	
	Cassia chamæcrista. (*)	
B. desertorum Lec.	Prosopis. (13)	
	Strombocarpus. (13)	
	S. pubescens. (11)	
	Plant No. 1108 (Palmer). (16c)	
B. discoideus Say.	Ipomœa. (15a)	
	Ipomœa leptophylla. (*)	
B. discolor Horn.	Prosopis. (21b)	
	Parkinsonia. (21b)	
	Cassia rœmeriana. (9)	
B. distinguendus Horn.	Cracca virginiana. (3)	
	Rhynchosia latifolia. (*)	
B. exiguus Horn.	Amorpha fruticosa. (16c, 14a, 3,*)	Heterospilus prosopidis Vier. (22b,*)
		Glyptocolastes bruchivorus Cwfd. (*)
		Microdontomerus anthonomi Cwfd. (14b,*)
		Eurytoma tylodermatis Ashm. (14b)
		Eurytoma sp. (*)
		Cerambycobius cyaniceps Ashm. (5a, 14b,*)
		C. brevicaudus Cwfd. (6b, 14b,*)
		Eupelmid. (*)
		Meraporus bruchivorus Ashm. (1b)
		Catolaccus incertus Ashm. (14b,*)
		Horismenus sp. (*)
B. flavicornis Shp.	Abutilon holosericeum. (21b)	
B. fraterculus Horn.	Hedysarum boreale. (16c)	Bracon xanthostigma Cr. (2)
	Glycyrrhiza lepidota. (2)	[= Microbracon mellitor Say.]
		Eurytoma sp. (2)
		Pteromalid. (2)
B. hibisci Ol.	Hibiscus moscheutos. (16c, 3)	
	H. sp. (militaris ?) (16c)	
	H. militaris. (*)	
	Abutilon abutilon. (*)	
B. julianus Horn.	"Undoubtedly breeds in seed-pods of Acacia flexicaulis." (18a)	Horismenus sp. (*)
	Siderocarpus flexicaule. (*)	
B. leucosomus Shp.	Ipomœa. (16c)	
B. limbatus Horn.	"Tenasa" pod. (*)	
	Siderocarpus flexicaule. (*)	
B. longicollis Fabr.	Canavalbia n. sp. (16c)	
B. longistilus Horn.	"Said to breed in seeds of mallows." (3)	
B. mimus Horn.	Cercis canadensis. (*)	Gylptocolastes bruchivorus Cwfd. (*)
		Cerambycobius cyaniceps Ashm. (*)
		Horismenus sp. (*)
B. obsoletus Say.	"From seeds of an *Astragulus* in August in company with *Apion segnipes*." (17)	

TABLE OF HOSTS AND PARASITES OF BRUCHIDÆ—*Continued*

Species	Host-plants	Parasites
B. obsoletus Say (*continued*)	Tephrosia virginiana. (15b, 16b, 5e) T. spicata. (12)	
B. obtectus Say. [= Acanthocelides. (5f)]	Cultivated beans. (Many authors.) Cowpeas. (5d) Lima beans. (16a) Peas. (19) Lentils. (19) Chick peas. (19) Lathyrus sativus. (19)	Cerambycobius cyaniceps Ashm. (5c) Bruchobius laticollis Ashm. (5c) [= B. laticeps Ashm. (*)]
B. ochraceus Schaeff.	Vicia sp. (near hirsuta.) (*)	Heterospilus prosopidis Vier. (22b see foot note 2, *) Microbracon sp. (Doubtful *) Eurytoma sp. (*) Cerambycobius cyaniceps Ashm. (*) C. cushmani Cwfd. (*)
B. ochreolineatus Fall.	Mimosa fragrans. (? *)	Glyptocolastes bruchivorus Cwfd. (*) Undetermined chalcid. (*)
B. pisorum L. [= Laria. (5f)]	Peas. (Many authors.)	Bruchobius laticollis Ashm. (14b) [= B. laticeps Ashm. (*)]
B. placidus Horn.	"Two low, leguminous plants, probably species of Astragalus." (*)	
B. prosopis Lec.	Prosopis glandulosa. (13, many authors, *)	Urosigalphus bruchi Cwfd. (6a, 14b,*)
	Strombocarpus. (13, many authors.)	Glyptocolastes texanus (Ashm.). Cwfd. (6d see footnote 3)
	Prosopis velutina. (*)	Heterospilus prosopidis Vier. (22b) Undetermined chalcid. (*) Undetermined proctotrypid. (*)
B. protractus Horn.	Prosopis glandulosa. (16c)	
B. pruininus Horn.	Olneya tesota (= tesota). (16c) Ironwood tree (11) (probably *O. tesota*) (16c)	
B. quadridentatus Schaeff.	"Tenaza" pod. (*)	Glyptocolastes bruchivorus Cwfd. (*) Urosigalphus bruchi Cwfd. (*) Phanerotoma sp. (*) Heterospilus prosopidis Vier. (22a see footnote 4,*) Cerambycobius sp. (*) Parasierola distinguenda Kieff. (*)
B. quadrimaculatus Fab. [= Pachymerus. (5f)]	Black-eyed table beans. (16c) Cowpeas. (Many authors,*) Peas. (5c)	Aplastomorpha prattii Ashm. MS. (5c) Bruchobius laticollis Ashm. (5c) [= B. laticeps Ashm. (*)] "Three species of parasitic Pteromalinæ." (5b) "Two undetermined chalcids." (*)
B. rufimanus Boh.	Pea pods from Switzerland. (11) Peas. (16c) Beans (especially Windsor varieties). (5c)	
B. sallæi Shp.	Vachellia farnesiana. (14b,*) Acacia amentacea. (*)	Urosigalphus bruchi Cwfd. (14b,*) Glyptocolastes bruchivorus Cwfd. (6d see footnote 5,*)
	Gleditsia triacanthos. (*)	Heterospilus prosopidis Vier. (22b see footnote 6,*) Microbracon sp. (*) Lariophagus texanus Cwfd. (6c see footnote 7,*) Cerambycobius cyaniceps Ashm. (14b,*) C. cushmani Cwfd. (14b,*)

TABLE OF HOSTS AND PARASITES OF BRUCHIDÆ—*Concluded*

Species	Host-plant	Parasite
B. sallæi Shp. (*continued*)		C. bruchivorus Cwfd. (6b see footnote 8, 14b,*)
		Undetermined Eupelmid. (*)
		Eurytoma tylodermatis Ashm. (14b)
		E. spp. (*)
		Catolaccus sp. (*)
		Horismenus sp. (*)
		Parasierola distinguenda Kieff. (*)
		Cephalonomia hyalinipennis Ashm. (*)
		"Very minute chalcid possibly secondary." (*)
B. schrankiæ Horn.	Schrankia uncinata. (11)	
	Mimosa borealis. (*)	
B. triangularis Say.	"Mexican seeds the size of palmetto but concave within." (17)	
B. ulkei Horn.	Broad podded Palo berde (*Parkinsonia.*) (16c)	
	Parkinsonia aculeata. (*)	
B. uniformis Lec.	Prosopis. (12, 13, 16c)	
	Strombocarpus. (12, 13, 16c)	
B. sp.	Astragalus sp. (near *triflorus*). (*)	Eurytoma sp. (*)
		Undetermined chalcid. (*)
B. n. sp.	Prosopis pubescens. (16c)	
B. sp. (not reared).	Phaseolus pauciflorus. (16c)	
B. sp. (larvæ only observed).	Loco weed. (16c)	
B. (?) sp. (eggs on pod).	Acacia filicina. (16c)	
B. (No. 4324)	Plant No. 305 (Palmer). (16c)	
B. n. sp.	Prosopis. (21b)	
B. sp.	Lotus sp. (21a)	Bruchophagus mexicanus Ashm. (21a)
B. sp.		Bruchophagus borealis Ashm. (1c)
Laria sp. in *Vachellia*. (14b) [= Bruchus sallæi. (*)]		

[1] Hunter No. 1455 mentioned in the description of this species refers to *B. compressicornis* and *B. bisignatus;* but as *bisignatus* was not reared from the locality mentioned, the specimens of *H. prosopidis* were parasitic on *B. compressicornis.*

[2] Hunter No. 1454 mentioned in the description refers to *B. ochraceus.*

[3] In his redescription of this species Crawford gives the following: "Type specimens bred from *Prosopis juliflora*, where it was probably parasitic on *Bruchus prosopis.*"

[4] Hunter No. 1700 mentioned in the description of this species refers to *B. quadridentatus.*

[5] Although the type specimens of this species are labelled "Parasite of *Bruchus prosopis*" as indicated in the description, the other labels on the pins show that they were bred from *B. sallæi.* The discrepancy is due to an erroneous determination of the host.

[6] The paratypes recorded in the description as bred from *Bruchus prosopis* were so labelled through a mistaken determination of the host.

[7] The type specimens of this species are labelled as indicated in the description as parasitic on *Laria* (*Bruchus*) *prosopis.* This was, however, an erroneous determination of the host. The other labels on the pins show the host to have been *B. sallæi.*

[8] The description of this species records the types as having been "bred from *Bruchus* sp. on *Vachellia.* The *Bruchus* sp. is *B. sallæi.*

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The following bibliography is not complete in that it does not include many of the references to the economic species of the family.

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SCALE INSECT PARASITISM IN CALIFORNIA

By H. J. QUAYLE

More activity has been manifested in the importation and propagation of Coccid parasites in California than in any other place in the world. The State Horticultural Commission has been active in this work ever since the introduction of *Novius cardinalis* from Australia in 1889. During this time much good work has been done and several importations have been successfully established in the State. In most of these cases of successful introductions it is assumed that the Bureau of Entomology at Washington played an important part, and usually has taken the initiative. This paper will not review the history of this work, but will present a brief account of the present status of scale parasitism in the State, which will include the native species as well as the importations.

SAN JOSÉ SCALE

(*Aspidiotus perniciosus* Comst.)

The statement is frequently made that the San José scale is no longer a pest in California because of its parasitic enemy, *Aphelinus fuscipennis* How. But this is based upon no studies whatever and in most cases is merely an inference. While the writer has accumulated no extensive data on the amount of this parasitism, what has

been obtained from several different sections of the State during the last five or six years does not show that the parasite in question is an important factor in keeping the scale in check.

Aphelinus fuscipennis How. is probably the commonest species attacking the scale in the State, while *A. mytilaspidis* is also frequently met with. Usually the number of these issuing has been small in comparison with the number of scales. We have found no such numbers, for instance, as Johnson found in Maryland some years ago. Very large numbers issued from his material and it is presumed that the percentage ran high.

It is true that in the Santa Clara Valley where the San José scale first started in this country, it is no longer regarded as a serious pest, but further data are necessary to prove that parasites are responsible for this condition. A very considerable amount of the lime sulphur spray is used in the State each year and chiefly against this scale, and the general efficiency of this wash has done more than anything else to allay the fears that were formerly held against the insect. But where neither the parasites are present in sufficient numbers nor has the wash been applied, the scale no longer occurs in alarming numbers as formerly; and what is true of the Santa Clara Valley is true in many other parts of the State. Again we have seen apple, pear and plum trees practically killed by this scale as late as this present year.

THE RED SCALE

(*Chrysomphalus aurantii* Mask.)

At the present time *Aphelinus diaspidis* How. is the most widely distributed and abundant parasite of the red scale in the State. Counts made on large numbers of this scale show that the percentage parasitized varies from 1 or 2 per cent to 15 or 20 per cent. *Aspidiotiphagus citrinus* Craw. also occurs in some numbers, but the highest percentage found was with the yellow scale as given below. Other parasites recorded from this scale in the State are: *Prospaltella aurantii* How., *Signiphora occidentalis* How., and *Aphycus immaculatus* How.

THE YELLOW SCALE

(*Chrysomphalus aurantii* var. *citrinus* Coq.)

The most important parasite of this scale is *Aspidiotiphagus citrinus* Craw. While it attacks the red scale, it has been most frequently met with and occurs in largest numbers on the yellow. Yellow scale material has been obtained in several places in the southern California citrus belt with no, or little, evidence of the parasite, while in others as high as 40 per cent has been obtained. But it is on

the citrus trees of the Sacramento Valley where this parasite is to be found in the greatest numbers. Examination of 5,000 scales recently received from that section showed 67 per cent parasitized.

THE BLACK SCALE

(*Saissetia oleae* Bern.)

Scutellista cyanea Motsch. outranks all other enemies of the black scale in California. This is the first of the parasites thus far mentioned that has been intentionally introduced. It was first found in Europe and later in South Africa, from which country it was introduced into California in 1900. As high as 75 and 80 per cent of the black scales may be found with the exit holes of Scutellista. The eggs of the scale are consumed by this parasite, while the others mentioned above live either in or on the body of the scale insect as endoparasites or ectoparasites, *Aspidiotiphagus* being an example of the former and *Aphelinus* of the latter. *Tomocera californica* How. is another egg parasite of the black scale, but is not nearly so abundant as is the Scutellista. Less than 10 per cent is the maximum number taken in recent years, though thirty years ago it was said to be as abundant as Scutellista is today. *Aphycus flavus* How., attacks the young black scales and also the males but never in very large numbers. *Coccophagus lecanii* Fitch., and *C. lunulatus* How., have also been reared from the black scale.

SOFT BROWN SCALE

(*Coccus hesperidum* Linn.)

This species is one of the most abundantly parasitized scales in the State, and is no doubt often kept in check through their attacks. All of the species, so far as known, are also native parasites. Of three or four species it is difficult to say which is the most important, since different species may predominate in different sections, or first one and then another attain the ascendency in the same section. The four most important and probably in the order named are: *Encyrtus flavus* How. *Aphycus flavus* How., *Coccophagus lunulatus* How., and *C. lecanii* Fitch. Mr. P. H. Timberlake has reared four other parasites from this scale, two of which are secondary, but these are less common than the four named.

EUROPEAN FRUIT LECANIUM

(*Lecanium corni* Bouche.)

The most important parasite attacking this scale is *Comys fusca* How. Others as *Coccophagus lecanii* and *Aphycus flavus* attack the

scale in its younger stages but are less numerous than *Comys fusca*. This scale is also said to be kept in check through the work of the above parasite, A statistical study of the parasitism of this scale made a few years ago[1] showed that, in 67,000 scales examined in all parts of the state, the maximum in any orchard was 47.6 per cent, and the minimum in any orchard 1.9 per cent, with a general average for the whole state of 12 per cent. This represents but a single season's observations and no doubt in some cases may run higher than that given, but nevertheless it is not within the facts to state that this scale is held in check by *Comys fusca*.

PURPLE SCALE

(*Lepidosaphes beckii* Newm.)

This scale has always been considered freer from parasites than any of the scales of economic importance in the State. While this, in general, is true and purple scale material will usually be obtained with no evidence of parasitism, yet in certain sections a considerable amount of parasitism may occur. The only parasite taken from this scale thus far, is *Aspidiotiphagus citrinus* Craw. A few cases have been found where the maximum parasitization ran between 40 and 50 per cent.

COTTONY CUSHION SCALE

(*Icerya purchasi* Mask.)

A parasite that was introduced at the same time as *Novius cardinalis* to prey upon the cottony cushion scale was the dipterous species *Cryptochætum icerya* Will. On account of the overshadowing results of *N. cardinalis* this internal parasite was largely forgotten. At the present time it is not uncommon to find this parasite, but it is still much less important than the beetle. The heaviest parasitism by *Cryptochætum* was observed on cottony cushion scale infesting an acacia tree, and without making actual counts, the percentage seemed to run at probably 50 or 60 per cent.

PREDACEOUS ENEMIES

Coccinellids, while not coming within parasitic enemies in the narrower sense, are often nevertheless included, and a few will be here briefly considered.

The one importation that stands preëminently above all others is *Novius cardinalis* concerning which every entomologist is familiar. The cottony cushion scale is no longer an important pest in the State,

[1] Science, May 15, 1908.

and chief credit for this is usually given to the beetle. There are cases, however, where for some reason or another, the beetle has not been able to prevent the scale doing very considerable injury to the tree; and there are also cases where the scale is harmless and where there are no beetles.

The most important Coccinellid attacking the black scale is *Rhizobius ventralis* Black, which was introduced at the same time as *cardinalis*. This beetle and its larva feed upon the eggs and younger stages of the scale and while very common has never been seen in large numbers. Another species of the genus, *Rhizobius lophanthæ* Blaisd. is the most important Coccinellid attacking the red, yellow and purple scales in the State. This species was first described from California, but it appears that it was imported along with several others and that it was lost track of for some time. In a grove in San Diego County where the owner was assured his red scale was kept in check by a species of *Aphelinus*, an examination of 2,000 scales showed that 3.3 per cent were attacked by *Aphelinus*, 2.2 per cent by *Aspidiotiphagus* and nearly 23 per cent by *Rhizobius lophanthæ*. Greater actual evidence of the work of Coccinellids was shown in this case than any that has come to our notice. Coccinellids and other predaceous enemies may, of course, consume many of the young scales and eggs, and of which no evidence remains, but we are here considering only the attacks on the fixed scales. The Coccinellid, *Cryptolæmus montrouzeri* Muls. another of Koebele's introductions, is the most important species attacking the citrus mealy bug *Pseudococcus citri* Risso, at the present time. This beetle often appears in large numbers and sometimes greatly reduces the number of mealy bugs, but the effects of the beetle are too irregular, and the trees are never free from the sooty mold fungus. There are several species of native Coccinellids that may feed on scale insects but these need not be considered here.

CONCLUSION

With the exception of the soft brown scale, the cottony cushion scale and probably the mealy bug, the insects mentioned in the foregoing pages are the most serious scale pests attacking citrus and deciduous fruit trees in the State. In the citrus belt of southern California more than half a million dollars are expended annually in fumigating and spraying for the black, red, yellow and purple scales. More fumigation is practiced in proportion to the acreage than ever before. Of the four scales mentioned, the black is probably the most important. Of the scales attacking deciduous trees, the San José and Apricot or European Fruit Lecanium are the most

important. While the San José is very much less virulent than formerly, the quantity of lime sulphur applied to control it each year is very considerable; and more spraying is done to control the apricot scale than ever before.

Of the parasites discussed, two—*Scutellista cyanea* and *Cryptochætum icerya*—have been introduced. Of the Coccinellids mentioned all have been introduced. While it should not be claimed that these parasitic and predatory insects are not of considerable service, yet if they are to be judged rigidly on results in commercial orchards, they cannot be rated very highly. The writer thoroughly believes in making all possible use of natural enemies to control injurious species, but at the same time he cannot concur in the belief that most scale insects in California are so controlled.

TEST SPRAYINGS FOR THE GLOOMY SCALE (CHRYSOMPHALUS TENEBRICOSUS COMST.)

By Z. P. Metcalf, *State Department of Agriculture, Raleigh, N. C.*

The Gloomy Scale is the most important insect enemy of shade trees in North Carolina, and is well distributed over all this State south and east of the mountains. Its importance is due to two factors: the enormous rapidity with which it breeds and the fact that it is all but completely confined to the soft maples which have been so largely used for shade purposes in our cities and towns. The following tabulated results of careful tree to tree inspection of the maples in portions of Raleigh and Red Springs will serve to make this clear.

RALEIGH. NEWBERN AVENUE AND EDENTON STREET

Name of Tree	Total number of trees	Not infested	Infested	
			Slightly	Badly
Silver Maple	18	5	4	9
Red Maple	39	13	9	17
Sugar Maple	98	98	0	0
Norway Maple	3	3	0	0
Box Elder	1	1	0	0

RED SPRINGS. MAIN STREET AND ADJACENT LAWNS

Name of Tree	Total number of trees	Not infested	Infested		
			Slightly	Moderately	Badly
Silver Maple	28	0	9	8	11
Red Maple	6	0	1	4	1
Southern Red Maple	1	0	1	0	0
Sugar Maple	1	1	0	0	0

These results have been verified by more or less extensive inspections in all of the larger towns of the State, and while a few hard maples have been found infested with the Gloomy Scale, our inspections would show that hard maples are at least highly resistant to the attacks of this scale. We have frequently found a hard maple entirely free from Gloomy Scale growing between two soft maples which were dying from its attacks. This suggests that the present condition will naturally correct itself in time, because people will cease to plant the quick growing soft maples and set in their stead the slow growing resistant hard maples. In this connection the following list of host plants which have come under our own observation is given:

Apple, (Pyrus malus L.) Several young trees growing under the overhanging branches of badly infested red maples found slightly infested.

Red Maple. (Acer rubrum L.) Generally infested.

Silver Maple. (Acer saccharinum L.) Uniformly and badly infested.

Sugar Maple. (Acer saccharum Marsh.) A few scattering individuals found infested, mostly very slightly.

Box Elder. (Acer negundo L.) A few infested.

Buckeye. (Æsculus glabra Willd.) Slightly infested.

Japanese Chestnut. (Castanea sativa.) Badly infested.

Sycamore. (Platanus occidentalis L.) Slightly infested

Water Oak. (Quercus nigra L.) A single tree slightly infested.

White Oak. (Quercus alba L.) A few trees slightly infested.

Iron-wood. (Carpinus caroliniana Walt.) A single badly infested tree.

Willow. (Salix sp.) A small badly infested tree found along a stream in Lincoln County.

Cottonwood. (Populus deltoidea Marsh.) Slightly infested tree.

American Elm. (Ulmus americana L.) Slightly infested.

When our attention was first called to the destructive work of the Gloomy Scale, it was our belief that home-made lime-sulphur (15–15–50 or 15–15–30) or kerosene emulsion at 15, 20 or 25 per cent oil would effectively control it, therefore during 1908 and 1909 various experiments were tried as follows:

Home-made Lime-sulphur (15–15–50). Trees were sprayed in mid December and late February. Some benefits but not a satisfactory remedy.

Home-made Lime-sulphur (15–15–30). Trees were sprayed in mid December and the trees did better after the spraying, but it was not a satisfactory remedy.

Kerosene Emulsion (25 per cent oil). Trees were sprayed in late February. Not a satisfactory remedy, for practically no scale were killed.

Kerosene Emulsion (20 per cent oil). Same as for 25 per cent oil.

Kerosene Emulsion (15 per cent oil). Trees sprayed in early May. No benefits derived from this spraying.

After these home-made remedies had proven so entirely unsatisfactory, we determined to try all of the better known commercial preparations during 1910. A number of home-made preparations were also tried. Most of these mixtures have been previously recommended for the San José scale, but had been abandoned for the home-made lime-sulphur wash. These experiments were divided into three groups. The first series of trees (I) were sprayed in late December while the trees were dormant. The second series of trees (II) were sprayed in late February while the sap was rising and just when the buds were beginning to swell. The third series (III) were sprayed in early May while most of the first brood of young were crawling about or had just settled on the limbs.

The results of these experiments are given herewith.

COMMERCIAL

Insecticides	Strength	Time		
		Winter I	Spring II	Summer III
Scalecide	1–8	excellent	excellent	
	1–10	excellent	excellent	
	1–12	very good		
	1–50			poor
Orchard Brand soluble oil	1–5	excellent		
	1–8	excellent	excellent	
	1–10	good	good	
	1–50			fair

COMMERCIAL—*Continued*

Insecticides	Strength	Time		
		Winter I	Spring II	Summer III
Orchard Brand lime-sulphur	1–5	fair		
	1–8	poor	poor	
	1–10	poor	poor	
	1–25			very poor
Scaleoil	1–8	good		
	1–10	good		
	1–30			poor
	1–40			poor
Grasselli's lime-sulphur	1–5	fair		
	1–8	fair	fair	
	1–10	poor	poor	
	1–25			poor
Sherwin-Williams lime-sulphur	1–8		fair	
	1–10		poor	
	1–25			poor
Sherwin-Williams soda-sulphur	1–25			poor
Rex lime-sulphur	1–10		fair	
	1–25			poor
Target Brand scale destroyer	1–8	excellent	excellent	
	1–10	very good	good	
	1–12	good		
	1–40			poor
Spray-on	1–10		excellent	
	1–12		excellent	
	1–50			fair
One-for-all	1–8		very good	
	1–25			poor
Bowker's lime-sulphur	1–5	fair	fair	
	1–8	fair	fair	
	1–35			fair
Bowker's tree soap	1 lb. to 1 gal. water			fair
Whale Oil soap (Good's potash No. 3)	1 lb. to 1 gal. water			fair
Bowker's insect emulsion	1–15			poor
Niagara Brand lime-sulphur	1–8		good	
	1–10		fair	
	1–25			poor
Scale clean	1–10		excellent	
	1–12		good	
	1–30			poor

COMMERCIAL—*Concluded*

Insecticides	Strength	Time		
		Winter I	Spring II	Summer III
Scalime	1–5		poor	
	1–8		poor	
	1–25			fair
San-U-Zay	1–10		excellent	
	1–12		good	
	1–30			poor
Bogart's sulphur compound	1–5		fair	
	1–8		fair	
	1–25			fair
Pratt's carboline	1–25			fair
Home-made				
Pure Kerosene, tested for its killing properties		poor	tree killed	
Kerosene emulsion: 40%		fair	fair	
50%		fair	fair	
60%		fair	tree killed	
30%				poor
Cotton Oil emulsion (Cooley's formula)		fair	fair	
Linseed Oil emulsion (Cooley's formula)		fair	fair	

Carbolic Kerosene Emulsion

1 lb. soap,
30 gals. water,
3 gals. kerosene,
3 gals. carbolic acid (crude).

Kerosene emulsion made as usual with the addition of the carbolic acid, and the whole thoroughly emulsified. III poor.

The trees used for these experiments were inspected and the relative state of their infestation was ascertained as carefully as possible before commencing the spraying. After the trees were sprayed, they were inspected at intervals of two or three months for a year and a half. In this way we were able to determine not only the immediate effects upon the trees, but also the results on the tree as a whole. In making our inspection more attention was paid to the relative benefits to the whole tree than to careful counts and estimates of the per cent of scale killed.

Roughly speaking "excellent" in the above report means above 95

per cent of the scale killed. "Very good" means from 90 to 95 per cent of the scale killed. "Good" means from 85 to 90 per cent. "Fair" means from 75 to 85 per cent. "Poor" means from 50 to 75 per cent. "Very poor" means less than 50 per cent. In our experience too much dependence cannot be placed on counts of a thousand scale unless they are drawn carefully from all portions of the tree. Careful observations have shown that the normal mortality of the Gloomy Scale varies from nothing to more than 90 per cent on different parts of the same tree, so that it would be possible for one to count a thousand scale on an untreated tree and estimate that it had done better than a tree which had been carefully sprayed with the best mixture known at the present time. Careful inspections show that the critical points for inspection purposes are the bases of the new growth and protected crotches. However a successful treatment always makes itself evident in the appearance and general vigor of the tree, the growth of the new wood and the expansion of the bark. The critical inspections, however, were the ones made in late May when practically all of the young of the first brood had settled and become permanently attached to the branches. The pale grayish young were then very conspicuous among the old black scales and their relative abundance at that time indicated very clearly the number of old scale that were still alive,

From the above tests it seems safe to conclude that any of the soluble oils at 1 to 8 or 1 to 10 are satisfactory remedies for the Gloomy Scale if used while the tree is dormant, one application being sufficient for several years where the scale is slight or moderate. Where the scale is bad two or more applications are advisable. Better results were obtained where the tree was sprayed twice in the same year than where it was sprayed only once.

None of the commercial lime sulphur washes were as satisfactory for controlling the Gloomy Scale as the soluble oils. This we believe is accounted for by the fact that the dorsal scale of this insect is thicker and applied more closely to the ventral scale than is the case in the San José scale. Our observations would lead us to believe that the oils owe their superior killing powers to the fact that they remain moist much longer than the lime-sulphur preparations and are thereby enabled to creep in between the dorsal and ventral scales. The corrosive lime-sulphur washes do not seem to be able to penetrate the thick dorsal scale of this insect. Some of the lime-sulphur washes gave fair results and if spraying for the Gloomy Scale could be repeated year after year, as in the case of the San José scale, they might be recommended. But with shade trees this is usually not practicable.

None of the spring applications were at all satisfactory, and it was

impossible to see that any of the trees sprayed in the spring had been benefited to any marked degree. This we believe is due to the fact that the breeding period of the Gloomy Scale is quite protracted and while the weaker spray mixtures which can be used in the summer without injuring the leaves will kill the young unprotected scale, they are not strong enough to kill the old scale which later gives birth to more young.

Nothing in this report, however, is to be construed as having any bearing upon the value of the various mixtures tried as San José scale remedies.

The writer acknowledges his indebtedness to Mr. S. C. Clapp, field inspector of this office, for his assistance in inspecting the sprayed trees.

THE PYRALID (OMPHALOCERA DENTOSA GROTE), A PEST OF BARBERRY HEDGES

By W. E. Britton, *Agricultural Experiment Station, New Haven, Conn.*

On August 12th, 1908, Dr. F. P. Gulliver of Norwich, Conn., sent to the station some curious black and white caterpillars which were feeding upon the leaves of common barberry, *Berberis vulgaris* Linn. This plant, though introduced from Europe, has become naturalized in New England and is far more common in Connecticut than the native species *B. canadensis* Pursh. The writer was away on a vacation, and his assistant, Mr. Walden, who was in charge of the department, not recognizing the caterpillars, wrote to Doctor Gulliver asking him to send more material, which he kindly did. The writer examined the capterpillars on his return September 1st, but they were entirely unfamiliar to him. In his experience of fourteen years in the State he had not at that time ever seen the species before. A few specimens were inflated, and the others placed in the breeding cages for the purpose of rearing the adults, but none were obtained. The following season the insect was not observed by any one connected with this office.

In 1910, however, this insect was more abundant than previously, and a number of caterpillars were found feeding upon not only the common barberry, *B. vulgaris* and its purple-leaved form, but also on the Japanese barberry, *B. thunbergii* D. C. which is used rather extensively for hedges, though not as commonly as California privet and on another species of barberry. Enough material was secured in 1910 to enable us to rear the adults, and both sexes were obtained.

During the annual task of inspecting nurseries the work of this

insect was observed in 1910, especially about New Haven, and in 1911 its work was again noticed.

Habits and Injury

The adults emerged in the insectary from April 10th to 20th, but they do not appear in the open until about the first of July. On July 3d, 1911, specimens were collected by the writer on the screen door of his house, the moths having been attracted by the light in the hall. As there is a low hedge of Japanese barberry in front of the house and only a few feet away, they were doubtless there for the purpose of ovipositing, and later a few caterpillars were found on this hedge.

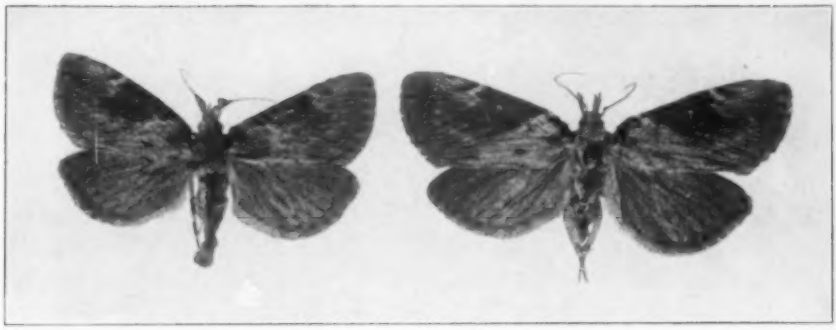
The writer and his assistants hunted for the eggs, but could not find them. Presumably they are laid on the leaves of the food plant. The writer's hedge was slightly attacked in both 1910 and 1911. In one instance a tall hedge of *B. vulgaris* near the writer's home was almost entirely stripped of leaves at the top for a distance of two or three rods, leaving only the old webs containing the excrement, and rendering the hedge very unsightly. Spraying with lead arsenate would, of course, be the remedy.

The larva spins a web in which is collected the excrement, giving to the web a brown or dark gray color. This forms a case in which the larva lives and feeds. It is usually about two inches long and from three-eighths to one-half inch in thickness, though varying greatly in size and sometimes being several inches long. The case is attached to the leaves or twigs of the barberry and often includes both, as well as the fruit. As the eggs are laid about July 1st, it is usually a month later before larvæ or nests are noticed, and often two months later before they are conspicuous. After the leaves drop the old nests or webs disfigure the plants throughout the winter unless removed. The larvæ do not pupate in the nests, but go into the ground and transform in a tough cell, oval or oblong in shape and made of particles of soil held together by silk threads.

Identity and Literature

On account of the appearance and characteristic position of this moth when at rest with wings folded, as well as the antennal tufts of the male, it was thought to be a Deltoid, and specimens were sent for identification to Prof. J. B. Smith, who kindly replied as follows:

"Yours of the 5th inst. came duly to hand, and so did the box of specimens. The latter proved to be not Deltoids or Noctuids at all! —they belong to one of the Pyralid families, and the species is *Omphalocera dentosa*. I am under the impression that this species was



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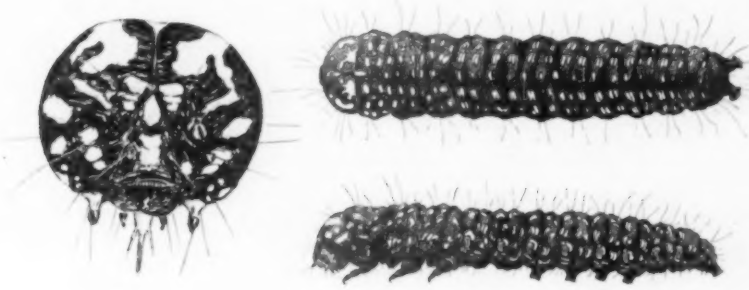

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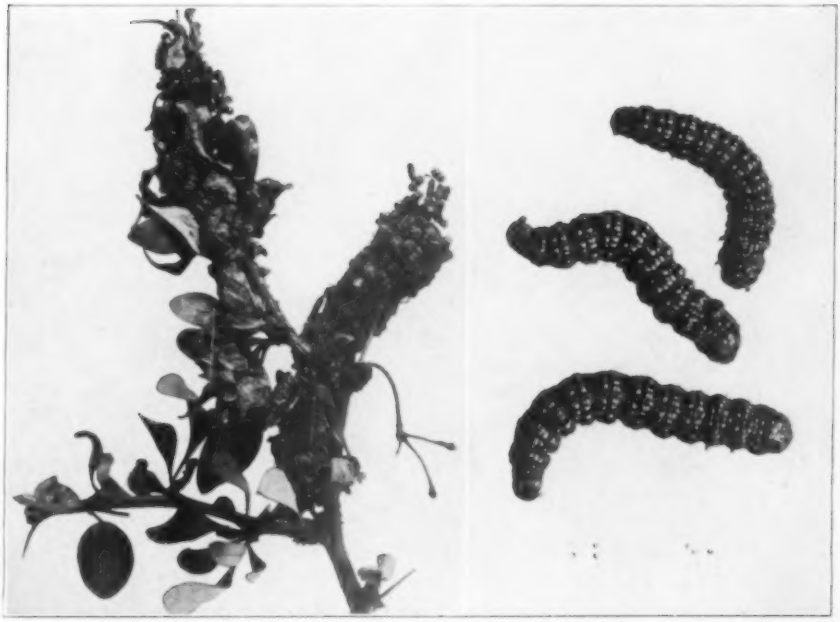

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Omphalocera dentosa: *a*. Adults nearly twice enlarged; male at left. *b*. Larva, dorsal and lateral views, about twice enlarged. Front view of head at left, greatly enlarged. *c*. Nest at left, natural size. Larvæ at right, twice enlarged.

described and figured in one of the Government publications, but have no note on the subject, and can't be sure at the present time. I know that nothing much has been written concerning the species."

In searching the more accessible works for the literature of the species, only two references could be found. One of these was the original description which is included in this article, and the other a brief note by Dr. H. G. Dyar in an article entitled,—"A Review of the North American Pyralinæ" (Proceedings Entomological Society of Washington, Vol. X, p. 101, 1908), giving records as follows:

Omphalocera dentosa Grote.

"New Haven, Conn. (A. H. Verrill); Plummer's Island, Maryland, June 6, 1902 (H. S. Barber); Ames, Iowa, June 6, 1896 (C. P. Gillette); Black Jack Springs, Texas (Wm. Barnes); Dallas, Texas, May 31, 1896 (Dept. Agr. No. 6351), larvæ on *Berberis*. I have also a female from Durango, Colorado, that is less vinous in tone and more darkly colored, perhaps a distinct species, but with the present material I do not venture to separate it."

"Larvæ received from Mr. A. H. Verrill, which I think belong to this species, are black with many white dots, without the red lines of *cariosa*."

Dr. H. T. Fernald has also kindly examined the card index in his office and consulted his father's catalogue, and assures me that no other references occur there.

As the literature seems to be scanty, this brief article is submitted for publication in the hope that it may be of help to other workers who may collect or observe the caterpillars on barberry.

Description

Adult. The species was described from a female specimen by Grote, in Bull. U. S. Geological and Geographical Survey of the Territories Vol. VI, No. 2., p. 272, as follows:

Omphalocera dentosa, n. sp. *Female.* A little larger than *cariosa*, with quite a different color, being dusty olive brown, without any reddish brown tinges. The median space is dark blackish brown. The pattern of ornamentation is the same, but the outer line is composed of well-defined and rather broad, open teeth. The line is double, filled in by a pale shade, and is brought a little nearer the margin over the median nervules than in *cariosa*. The interspaces beyond the t. p. line show dentiform shadings of the lighter and darker colors of the wing. The fringes are dark. The terminal dots do not contrast as much as in *cariosa*. The veins are darker marked. *O. dentosa* has the under surface fuscous with a common external double line near the border, which seems a little less strongly dentate than in *cariosa*. The abdomen is furnished with brown tufts on the dorsum in both forms. In place of the discal mark (?) there is a pale dot on the subcostal vein and one below it on median vein, quite distinct in *cariosa*, hardly evident in *dentosa*, which expands 40 mil."

I have not been able to find any description of the male, and take it to be undescribed, but in the specimens reared it closely resembles

the female in color and markings. The median space is smaller and less well-defined, the markings are slightly less distinct, and it is smaller in size. Both sexes have the dark brown or black tufts on the dorsum of the abdomen, and the male has the brown antennal tufts and the longer anal tuft which are sexual characters.

The specimens reared are somewhat more of a reddish brown tint than one would expect from Grote's description, yet there is a distinct olive tint on the basal two thirds of the secondaries.

Larva. Length, about one and one-half inches, thickness about three sixteenths of an inch; somewhat flattened and thicker laterally than vertically. Ground color black dorsally, brown ventrally. Marked dorsally and laterally by small white irregular shaped spots arranged rather irregularly as follows: Two transverse rows on each segment as seen dorsally; three longitudinal rows as seen in lateral view, one nearly in line with the spiracles, one above and one below, these being in addition to the transverse dorsal rows of spots. Sometimes a fourth longitudinal row may be made out below the other three and at the base of the legs and pro-legs. Head dark brown or black, sculptured or pitted and shining; marked with white patches more or less irregular in shape, the arrangement not entirely symmetrical. Legs black and shining, with white patches on the first and second basal joints. Head and body sparsely covered with nearly straight light and dark hairs of medium length.

The larvæ, adults and nests are shown in Plate 20. Credit is due to my assistants, Messrs. B. H. Walden and A. B. Champlain, to the former for making the photographs and to the latter for the drawing of the larva. Also to Professors J. B. Smith and H. T. Fernald for the courtesies already mentioned.

INSECTS OF THE YEAR 1911 IN IOWA.

By R. L. Webster

The year 1911 in Iowa was characterized by an early spring and a long, dry summer. These weather conditions had much to do with the oscillations of insect life in the state during the year. The following notes deal with some of the more important insects on which observations were made this year in Iowa.

Lepidosaphes ulmi Linn. Not until this year did I realize what an important enemy to the apple tree was the oyster-shell scale. In the northern part of the state a large number of orchards are infested with this insect, many trees being very badly injured and some even killed by the scale. In March of this year I made a 40 mile auto trip in Worth county, in the northernmost tier of counties in the state, and found that scarcely an orchard in the county was not infested. Most of them were seriously injured. From observations made elsewhere

in northern Iowa it seems probable that other counties are equally as well infested with the oyster-shell scale as Worth county.

All of the samples of this scale which have been sent in to the Experiment station in recent years have come from the northern half of the state. The scale occurs in southern Iowa, but rarely, and when it is found, the infestation is light. I am not sure what is the cause for this difference, but think likely that it is on account of more favorable conditions for the development of certain natural enemies of the scale. This is probably especially true of certain mites, concerning which I shall have more to say at another time.

Monostegia ignota Norton. This strawberry slug, or at any rate the species which has gone under this name, was very common in strawberry patches about Ames early in the spring. In one instance strawberry plants in a small field were practically eaten down to the ground by these slugs.

According to F. W. Mally there are in Iowa two common species of strawberry slugs.[1] These are quite similar and are doubtless often taken for a single species. In making some notes on these strawberry slugs this spring Mally's observations were found to be essentially correct. The second species of strawberry slug, *Harpiphorus maculatus* Norton, is fairly common in Iowa, although the first named species has been causing the more damage. This is probably due to the fact that the former species appears earlier in the spring, when the strawberry plants are smaller and less resistant to insect injury.

Meliana albilinea Hübner. The wheat-head army-worm, which caused much damage to timothy in northern Iowa last year, was practically lost sight of this year. Early in June it looked as if much injury would be done, since the partly grown larvæ were very common in many places. The continued long period of dry weather, however, completely dried out the timothy plants and heads, as well as other grasses, and the larvæ were left without suitable food The drought checked the wheat-head army-worms as well as the timothy.

Epitrix cucumeris Harris. The potato flea-beetle was again abundant in Iowa this year. Around Ames much injury to the tubers was noticed, as well as to the foliage. The tunneling into the tubers was found to be essentially as described by F. C. Stewart as occurring in New York State.[2]

Erioeampoides limacina Retzius. The pear-slug was less abundant at several places in the state where it has been common for several years. This decrease in numbers seems to have been due, for the most

[1] Insect Life, vol. ii, p. 137.
[2] N. Y. Agr. Exp. Sta. Bul. 113.

part, to the abundance of one of its egg parasites, *Pentarthron minutum*, Riley.

Carpocapsa pomonella Linn. The destructive spring freeze of last year, which played havoc with fruit in the state, had its effect on the codling moth as well as on the fruit. Where there were any apples at all last year, the codling moth was fairly common this year. But where all the fruit was lost, the insect was very rare indeed.

About Ames, where there were a few apples last year, the codling moth infestation was about normal, possibly slightly less than normal. Two varieties of apples, Wealthy and Ralls, came through with a fair crop last year, but practically everything else was killed by the frost.

In July I made a short trip in southwestern Iowa, where the fruit industry is of some little importance. About Glenwood, in Mills county, scarcely a sign of a wormy apple was found. I found one wormy apple in a day's time spent in orchards about this place. A very few second brood eggs were seen at this time, but not many. Practically all the orchards in this county were unsprayed, which fact makes the absence of the codling moth all the more notable. Most of the orchards had never seen a spraying outfit.

South from Glenwood, about Hamburg, close to the Missouri line, there was more codling moth injury in the orchards. Here, again, there were some apples the year before, so the larvæ were not completely starved out, as at Glenwood. The infestation around Hamburg was light, however, and since much spraying is done there, the insect was well kept in check.

Canarsia hammondi Riley. At Randolph, in southwestern Iowa, I ran into a severe infestation of the apple leaf skeletonizer in July. This insect is not an uncommon one in the state, although it rarely occurs in abundance. In this particular orchard at Randolph every tree was more or less injured. The damage was mostly in the top of the trees, and always on the young growth. At the tops of the trees the young branches were eaten back from one to two feet, so that the upper parts of the trees were bare and brown. These trees were sprayed with arsenate of lead for the codling moth after the blossoms had fallen, but not again that season. Since the skeletonizers kept to the younger growth they avoided the poison to a great extent. A considerable amount of the arsenate of lead was found still adhering to the leaves late in July, the scant rainfall of the season being insufficient to wash it all off.

Grasshoppers. Three species of grasshoppers were abundant in Iowa this year, *Melanoplus bivittatus* Say, *Melanoplus femur-rubrum* DeG., and *Melanoplus differentialis* Thos. Much damage was done to corn and also to small grain. Even apple trees in the vicinity of

infested pastures or meadows were defoliated. The weather conditions in this case had much to do with the damage done by the grasshoppers. The dry weather had kept the pastures bare for a long period during the summer, so that the grasshoppers were forced to find their food elsewhere, consequently the damage to grain crops.

In August a number of newspaper reports were noticed which gave accounts of flights of the grasshoppers. These were mostly from northern Iowa

Blister beetles. Two species of blister beetles, *Epicauta vittata* Fab. and *Epicauta pennsylvanica* DeG., were common in Iowa this year. The former species was abundant on potatoes, the latter on alfalfa, potatoes and corn. One farmer near Spencer, Iowa, told me that the black blister beetle (*Epicauta pennsylvanica*) literally cleaned out a field of alfalfa for him.

Since the grasshoppers were very common in the state, there should be plenty of grasshopper eggs for the blister beetle larvæ this fall, and it is certainly safe to prophesy an abundance of these two species for next year.

Chætocnema elongatula Crotch. This tiny, black, flea beetle, kindly determined for me by Prof. H. F. Wickham, was found causing very serious damage to apple foliage in an orchard near Storm Lake, Iowa, in August. The injury to the foliage made itself known by a dried appearance around the outer margins of the leaves. This was caused by the removal of the upper epidermis, which allowed that part of the leaf to dry out. Whole trees were brown and ragged from the injury. Where the damage was worst many leaves were cut nearly into shreds. On some trees not a leaf had been left uninjured, so that the damage had been very severe and was very conspicuous.

At first I could not detect the cause of the injury, but finally found the beetles fairly common on the leaves. The worst of the damage had been done, apparently, when I examined the leaves, and the beetles were no doubt decreasing in numbers. The owner of this orchard told me that he noticed the injury in June or July, while I did not visit the place until August.

The orchard was an old one, and in sod. Possibly the larvæ of this beetle may have been breeding in the sod, and suddenly becoming numerous, caused the damage to the foliage. I am not aware that this species has ever been recorded as being of any economic importance.

METHODS OF DETERMINING THE TOXICITY OF HYDROCYANIC ACID GAS

By GEORGE A. COLEMAN

Recent investigations point to the conclusion that a large percentage of the killing value of the hydrocyanic acid gas generated in practical fumigation work is lost through leakage of tents.

In order to determine the toxic value of the different percentages of hydrocyanic acid gas an extensive series of experiments with known percentages of the gas was planned, including the study of large numbers of various species of scale insects in various stages of development from the egg to the adult, as well as other insects. This is now being carried on in the insecticide laboratory of the University of California by the author and a number of assistants under the direction of Professor Woodworth.

Since no such extensive work has been previously done along this line, it has been necessary to develop new methods of experimentation and apparatus. These have proven so satisfactory for the purpose that a description of the apparatus and methods of handling the scale insects may be of interest to other workers in this field of investigation.

The average dosage used in practical fumigation work rarely produces above 0.36 per cent HCN which Professor Woodworth estimates has an average efficiency of not to exceed 0.09 per cent HCN. Our work, therefore, is with percentages of gas from 0 per cent to 0.36 per cent.

In our experiments we begin with a very low percentage and increase it at will to any strength desired. The method used enables us to begin with a production of 0.005 per cent HCN or less and increase the production each time by this amount.

After considerable experimenting with the different cyanides and acids, we find the use of purified potassium cyanide (98–99 per cent or c. p.) and c. p. sulphuric acid (sp. gr. 1.84) gives the best results. For the gas generating vessel we use an ordinary Woulff bottle with three necks, of about 1000 cc, capacity. In this bottle is first placed 500 cc. of distilled water to which is added 5 grams of cyanide, and the acid is added as the gas is required. Beginning with sufficient cyanide to produce 0.005 per cent HCN in the air as it passes through the liquid solution, it is only necessary to add 0.1 cc. of concentrated H_2SO_4 in order to produce this percentage. As it is rather difficult to measure out so small a quantity of acid we use a 10 per cent solution and add 1 cc. instead of 0.1 cc.

For control of the gas production the following table, constructed from the results of a large number of experiments, can be depended upon to give very satisfactory results in production of the low percentages of gas required in the work.

1 Litre of Hydrogen = 0.0896 gram
1 Litre of HCN = .0896 × 0.906 (At. wt. HCN) = .8069 gram
1 cc. $AgNO_3$ N/10 = .00054 gram HCN. 1 cc. $AgNO_3$ N/100 = .000054 gram HCN
5 grams KCN (98–99%) in 500 cc. H_2O (distilled) at 15° C.

+5	cc. H_2SO_4 c. p. (10%)	=	.75 cc.	$AgNO_3$	N/100	=	.000040345	gram	HCN	=	.005%
+1	" " " "	=	1.5 "	"	"	=	.00008069	"	"	=	.01 %
+1	" " " "	=	2.25 "	"	"	=	.000121035	"	"	=	.015%
+1	" " " "	=	3. "	"	"	=	.00016138	"	"	=	.02 %
+1.5	" " " "	=	3.75 "	"	"	=	.000201725	"	"	=	.025%
+2	" " " "	=	4.5 "	"	"	=	.00024207	"	"	=	.03 %
+2	" " " "	=	5.25 "	"	"	=	.000282415	"	"	=	.035%
+2	" " " "	=	7.5 "	"	"	=	.0040345	"	"	=	.05 %
+2.5	grams KCN										
+3	cc. H_2SO_4 c. p. (10%)	=	11.2 "	"	"	=	.00605175	"	"	=	.075%
+5	" " " "	=	14.9 "	"	"	=	.008069	"	"	=	.1 %
+5	" " " "	=	22.4 "	"	"	=	.0121035	"	"	=	.15 %
+2.5	grams KCN										
+3	cc. H_2SO_4 c. p. (10%)	=	29.8 "	"	"	=	.016138	"	"	=	.2 %
+5	" " " "	=	39.2 "	"	"	=	.0201725	"	"	=	.25 %
+2.5	grams KCN										
+3	cc. H_2SO_4 (10%)	=	44.8 "	"	"	=	.024207	"	"	=	.3 %
+5	" " "	=	52.3 "	"	"	=	.0282415	"	"	=	.35 %

The amount of gas produced by the addition of the given quantity of acid will vary slightly at different temperatures. The quantities noted being for an average of 15°C. It will require slightly less at higher temperature and more at lower temperatures.

A centigrade thermometer is inserted through one hole in the cork in one neck of the Woulff bottle into the liquid and a record made of the temperatures throughout each experiment.

For measuring the acid a 25 cc. pipette graduated to 0.1 cc. and fitted with rubber tube and pinch cock for controlling the flow, mounted in a holder, is very satisfactory.

In order to eliminate all chance of leakage, or contamination of gas, a Novy's gas-jar (Plate 21) is used for treating large numbers of scale insects at one time. While for treating scale or other insects in series, a series of vials, each five inches in length, with two hole rubber corks through which glass tubing is passed, one tube reaching well down to the bottom of vial, the other just through the cork and the vials are connected in series as desired by rubber tubing (Plate 22).

One end of this series of vials is connected with the gas-generating bottle by rubber tubing. A calcium chloride tube being inserted if it is desired to use dry gas. The other end of the series is connected with a gas wash bottle of 250 cc. capacity in which is placed 200 cc. of N/100 solution of potassium hydrate (KOH). This flask is connected

with an aspirator of one litre capacity and it in turn connected with a vacuum filter pump fitted to the water faucet.

In order to get the full value of the air bubbles as gas conveyors a "Cottrell spiral" of very fine platinum wire is inserted in the end of a glass tube drawn down to a fine point and this tube runs through the cork in one neck of the Woulff bottle and a similar one placed in the KOH flask and the air in passing through them is thus broken up into tiny bubbles.

When a jar or a series of vials containing the scale or other insects is ready for treatment, all connections are made gas tight, the proper amount of acid added to the cyanide solution and the vacuum pump started. As soon as sufficient vacuum is created in the fumigating jar or vials, a stream of air comes bubbling through the cyanide solution, conveying the gas into the jar or vials, and through them into the KOH solution where it is collected for titrating.

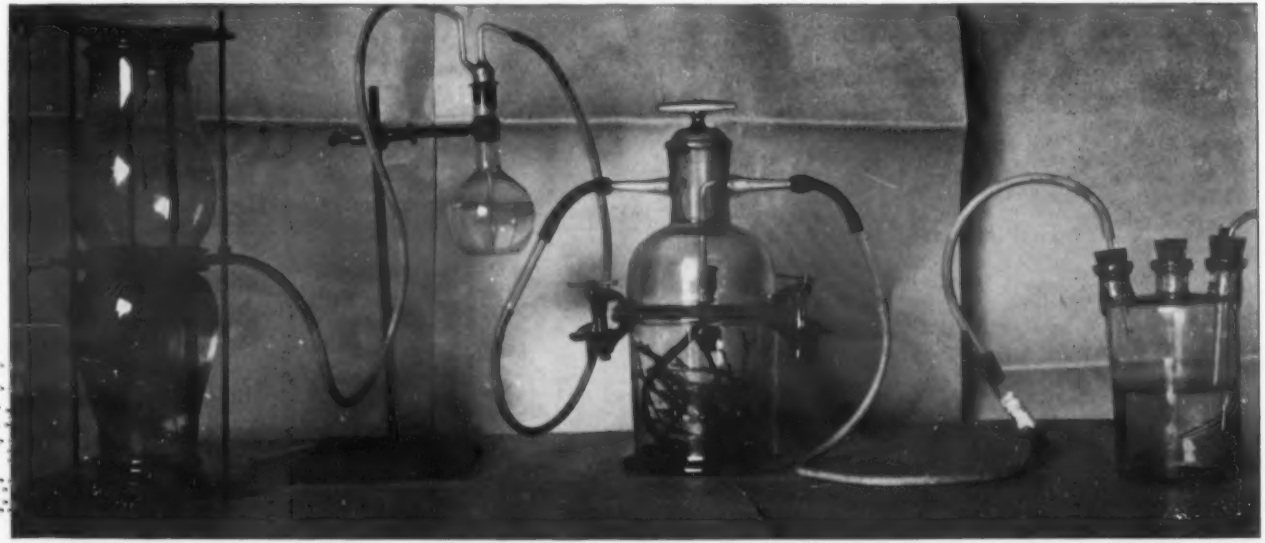
In order to allow of a thorough diffusion of the gas in the jar or vials, the pump is kept running for about fifteen minutes or 15 litres of gas run through. A fresh solution of KOH is then placed in the flask and two litres of gas, as measured by the aspirator, is run through and collected in the flask for titration.

The KOH solution is now titrated with silver nitrate ($AgNo_3$) solution using a N/100 solution instead of N/10 as the reaction with the weaker solution is more delicate and more easily controlled.

For measuring the titrate solution we use a 100 cc. Mohr's burette graduated to 0.1 cc.

For containing the insects we use the O size gelatine capsules, placing one or more insects in each capsule and one or two capsules in each vial. In fumigation the caps are removed from the capsules and afterward replaced. A series of living insects placed in capsules and subjected to the same conditions as to temperature, moisture, etc., but leaving out the cyanide treatment is kept as checks for each series of treated insects.

For keeping a record of each experiment a card, designed by Professor Woodworth, is used. This card contains appropriate headings for recording the locality, date, temperature, time, weight of cyanide, etc., and numbered spaces for thirty insects. When running series, we use one card for each percentage of gas, dividing the spaces into four lots, allowing one space for recording the living check and six spaces for recording the treated insects in each lot. The squares containing the numbers for treated insects are colored yellow with India ink while those for the checks are left white. This arrangement being of considerable assistance to the eye in recording quickly and accurately.



ILLUSTRATING APPARATUS USED IN FUMIGATION EXPERIMENTS

Beginning at the right,—Woulff bottle used for generating the HCN, Calcium Chloride tube for drying the gas, Novy's gas jar, gas wash bottle containing the KOH solution for collecting the HCN, one litre aspirator for measuring the amount of gas collected. (Original.)

The four lots are designated by letters of the alphabet and in each capsule containing an insect is placed a small label bearing, in pencil, the letter and serial number designating the exact place in the series of that particular insect. The four lots run through under each percentage of gas are allowed to remain in the gas for periods of fifteen, thirty, forty-five and sixty minutes respectively, the time being recorded on the card opposite each lot. We thus have the entire record for each series, with checks, on one card. For each stage or condition of the insect treated we run through at least nine of these entire series, representing as many different percentages of gas, in one day.

These series of treated insects and living checks are placed in glass tumblers or in common white envelopes for future examination or storage. The series are examined from time to time and careful records made on the cards of the recovery of any treated insects or death of the checks, so that when complete the results may be tabulated direct from these card records.

In preparing the insects for treatment they are handled as little as possible. The scale insects being treated mostly *in situ* on the twig, simply cutting the twig into short pieces holding one or more insects and one piece placed in each capsule. We have also treated the eggs and young *en mass* by placing large numbers in each capsule, and usually, where material will permit, a large number are treated in the Novy's jar as a check for those treated in vials for each percentage and also to record the effect on parasites.

For some series we use the gas as it comes from the generator saturated with moisture while for others it is dried by passing through a calcium chloride tube. Other entire series are placed in the large refrigerator in the basement of the Entomological building during treatment in order to record the effect at different temperatures.

For these experiments we require thousands of specimens of the various species of Coccidæ found in California. Many of these have already been collected, or their collection arranged for by Professor Woodworth on a recent trip through the Santa Clara Valley and the southern California citrus district for this purpose.

While it is desirable to obtain as large an amount of data as possible before tabulating the results of our experiments, they have been sufficiently comprehensive to show that the percentage of hydrocyanic acid gas necessary for killing the eggs, larvæ and adults of most species of Coccidæ where there is no leakage is less than .025 per cent or about one sixteenth the dosage used at present in fumigation work.

CARBON DISULPHIDE EXPLOSION FROM HEATED CORN

By W. E. Hinds, *Entomologist, Alabama Experiment Station, Auburn, Ala.*

For many years carbon disulphide has been quite extensively used for the destruction of insect life in stored grain and similar materials. There has been some hesitation in recommending this for general use because of the explosive nature of mixtures of the vapor of this material with air. It has been customary to state in connection with directions for treatment with this material, an explicit caution against allowing any form of fire to occur or be brought near the liquid carbon disulphide or the room in which it was being evaporated. The customary warning has been against lighted cigars, artificial lights of all kinds even including the turning on and off of electric lights and fans and also against exposing the liquid in rooms heated by steam while the steam was on.

So far as the writer has known personally, the accidents connected with the use of carbon disulphide have been very few indeed. In fact, the only explosion of which I have ever heard directly was started by the blow of a hammer upon a nail head in nailing up a box in which specimens had just been heavily treated with carbon disulphide. The explosion resulting in this case is stated to have landed the workman on top of some exhibition cases in the U. S. National Museum. No record of an explosion in connection with the treatment of storehouses or stored grain or other products has ever come to me personally until the present instance which I believe should be reported for the general information of those who may have occasion to recommend the use of this material.

In the southern part of Alabama especially, the "black weevil" or "rice weevil" is a most serious enemy to corn and many times accomplishes practically the complete destruction of corn even before Christmas. To protect corn from this and other insect pests we have recommended freely and used quite extensively carbon disulphide for fumigation. This treatment has given fairly good satisfaction where used in doses of from 15 to 20 lbs, per thousand cubic feet in tight cribs or buildings. Probably the most successful case of weevil control occurred on the very spot where the explosion which we are now reporting took place. Certainly it was the most successful that we have ever observed.

The owner of a large plantation near Montgomery, Ala., constructed a few years ago several solid concrete rooms for the storage of corn. The floor and the walls to a height of ten feet, are of solid concrete. A flooring occurs at the eaves line and the space under the roof is used

for the storage of hay. All partitions were made of matched flooring. Several strong rooms were thus constructed capable of holding several thousand bushels of corn. This place, therefore, offered ideal conditions for the control of corn infesting insects by carbon disulphide fumigation and treatment here during the two years preceding had given very satisfactory results.

Throughout the South there is a common custom of storing corn with the shucks on. Most farmers believe that this protects the ear from insect attack to some extent although we doubt whether this is really the case. It is a common idea that the best method of handling corn is to allow it to stand in the field until after one or two hard frosts have occurred, then to break the ear from the stalk during a rainy spell or while the shuck is real wet and store this wet corn immediately. Many farmers know that in large masses such wet corn is likely to heat and they seem to understand that the heating, occasionally at least, is quite effective in destroying insect life in the heated corn. So far as we have been able to learn very many of those who have followed both of these ideas have still lost their corn where any considerable quantity was carried in storage until May or June of the following year. It seems that a certain combination of conditions must exist to produce a degree of heat which will be sufficient to destroy insect life and that these conditions are not sufficiently understood so that the desired results can be attained with any degree of regularity and certainty.

In the case which we are considering a large force of workmen was put to harvesting the corn during a rainy period which made it impossible for them to continue their regular work of picking and ginning cotton. Thus in a single day, fully 1,200 bushels of corn in the shuck which was unusually wet were placed in one mass in this concrete building in a room containing about 2,400 cubic feet. One week after this corn was stored the carbon disulphide treatment was applied as the weevils were found to be very numerous in the corn at that time. The mass of corn was known to be hot but the owner had no suspicion that this heat was sufficient to be an element of danger in connection with the carbon disulphide treatment. The liquid was passed into the room and distributed over the corn by two negroes, the room being so full of corn that they had barely space to work around between the floor above and the top of the corn. Naturally the heat of the mass evaporated the carbon disulphide with unusual rapidity and when 30 lbs. of the liquid had been distributed, the vapor became so dense that the workmen were forced to retire. The door opening to the outside was immediately locked and the owner with one helper started pasting paper over the cracks around the door, which is about 3 x 3½ feet and

set about half way up the concrete wall. Within a minute after the pasting of the paper began, a "pop" was heard within the treated room and immediately this was followed by a low, rumbling explosion which blew the door off entirely and threw the workmen to a distance of about thirty feet. These men were unconscious for several minutes but not seriously hurt. The two in front of the door were protected from the flame by the door while another man standing beside the door was quite badly burned in the face, the flames being deflected toward him by the falling door. Fire immediately followed the explosion and in spite of the convenient presence of an abundant supply of water and a large force of men, it was found very difficult to extinguish the fire. The corn shucks were burned more or less to a depth of two or three feet in the mass. The gas still continuing to rise was too dilute for explosion but still inflammable and was not easily quenched even with an abundant supply of water. Undoubtedly the concrete wall together with the corrugated iron roof saved what must otherwise have been a complete loss of the building and contents.

As it is the explosion caused two slight cracks in the concrete wall a foot or more thick. The floor over the corn and the entire roof of the building was lifted probably at least a foot in height and then fell back to approximately its original position. Wooden partition walls were blown out in all directions. Heavy 4 x 4 studding was split and misplaced. It is evident that the explosion occurred throughout the mass of corn as corn was hurled in all directions. An interesting evidence of this may be seen where a 2 x 10 inch floor timber was split lengthwise about in the middle, the upper part being lifted with the floor above and a space thus occurred between it and the lower part which was lifted less. Between these two parts of this floor timber, five or six ears of corn were found wedged tightly after the explosion. They had evidently been caught in the act of passing through this space as the timbers settled together.

The injury to the grain was not great although the shucks were burned more or less on several hundred bushels of corn. Even on ears where the fire destroyed all of the shuck on one side, live, active weevils occurred and were evidently unaffected on the other side of the ear. The damage to the building is comparatively small on account of its type of construction but may prove to be greater than now appears.

Naturally an accident of this kind calls for the fullest investigation and this was given by the writer about two weeks after the explosion occurred.

After fully examining the premises, talking with those who had applied the treatment and studying the conditions existing at that

time, it seems absolutely impossible that the explosion should have started in this case from any fire source whatever. It is known that the vapor of carbon disulphide becomes explosive at a temperature of between 295 and 300° F. even without preceding flame. In this case it seems certain that the large mass of wet corn in the concrete building from which moisture could escape only upward, was at the time of treatment undergoing a heating which produced a temperature of at least 300° F. in some part of the mass. This high temperature started the explosion as soon as the vapor of the liquid poured on top of the corn had penetrated to a point where such heat occurred. This is probably the only case of its kind that has ever occurred. At the time of the examination, three weeks after the storage of the corn, all heat had disappeared from the mass and unquestionably treatment could have been repeated with entire safety as indeed the owner proposes to do.

As indicative of the high temperatures which may be produced under very similar conditions I might mention the heat known to occur where large masses of seed cotton was stored awaiting ginning. On the same plantation but a short time before this explosion, it was found in handling a large mass of such stored cotton that the hands of the workmen could not endure the temperature of the mass. Burlap sacking used to protect the hands was so charred and weakened by the high temperature that it quickly fell to pieces. Doubtless in this case also a temperature of over 300° F. occurred.

These cases are thus fully reported because it seems to the writer advisable henceforth to add one other precaution to those which are usually stated in connection with the recommendations for the use of carbon disulphide, that is that treatment with carbon disulphide should never be attempted where there is any evidence of high temperature occurring anywhere in the mass of grain or other material to be treated. Doubtless treatment might be given immediately upon storage before such heat developed or after a delay of two or three weeks' storage, which would allow the heat to pass off so that danger from it would also have passed.

PRELIMINARY REPORT OF THE COMMITTEE ON ENTOMOLOGICAL INVESTIGATIONS

By E. D. Sanderson, *Chairman*

As instructed at the last meeting of the American Association of Economic Entomologists, the committee on entomological investigations prepared the following letter which was sent to the heads of all departments conducting entomological investigations in this country:

Dear Sir:

At its last meeting the American Association of Economic Entomologists appointed a standing committee on Entomological Investigations. The object of this committee is outlined in the February number of the Journal of Economic Entomology, page 4, paragraph 2; pages 19 and 20, and in the report of Dr. T. J. Headlee on page 35, which please refer to.

It is the object of this committee to gather together data concerning the entomological investigations now in progress by members of the association and those contemplated during the coming year. It is proposed to publish a tabular statement of these projects in the December number of the Journal of Economic Entomology, so that those interested in similar projects can get together for conference at the next meeting if they so desire.

The committee trusts that it may have the very general coöperation of all members of the association in making this statement full and complete. At the next meeting of the association the committee will make a report embracing a general discussion of the investigation work being carried on. It was felt by the association that an interchange of information concerning investigations in hand and proposed, could not help but encourage voluntary coöperation on the part of the members, so that it would lead to planning their work together so that results might be more readily comparable and so that workers in the same field might be of greater mutual assistance.

Please give the following information for each project you are now prosecuting:

1. Name.
2. Object.
3. Reasons for undertaking.
4. Scope.
5. Coöperation with other departments, bureaus, or agencies.
6. General difficulties you are experiencing.
7. General methods you are using.
8. What proportion of the time of one or more men is devoted to this project?
9. Progress.
10. Source of funds used for support of the project.

Please give similar information for each project which you propose to undertake during the year 1912.

The committee will be greatly indebted if you will furnish this information to its chairman so that we can have it in hand by October 15 as it will take some time to collect the information and doubtless some correspondence will be necessary before we can complete the report.

And greatly oblige,

Very truly yours,

E. D. Sanderson, *Chairman.*

The replies which have been received to date (November 5) are arranged below according to subjects. Some ten or twelve correspondents are still to be heard from and their replies will be prepared in similar form and published in the next issue.

In the following list the letter before the name of the project indicates the fund under which it is carried on, insofar as the funds were indicated by the correspondent; (A) is for Adams Fund, (H) for Hatch Fund, and (S) for State Funds. In many cases where the entomologist of the experiment station is also state entomologist, it was not possible to determine from the replies made whether the project was carried on under experiment station funds or state appropriations. In many cases the correspondent failed to give the names of assistants carrying on certain lines of work, in which cases the statement is made to that effect.

This preliminary report is published at this time so that it may furnish the basis for conferences between those workers who are prosecuting similar investigations at the Washington meeting of the Association. The committee expect to present their final report at that meeting.

Acarina

1. Cattle tick; a study of its biology.
   C. F. Adams, Ark. Agr. Exp. Sta., Fayetteville, Ark.
2. (A) North American Fever Tick. Life history investigations and a study of the climatic factors affecting the fever tick with special reference to temperature. (Coöperation U. S. Bureau of Entomology and U. S. Weather Bureau.)
   E. C. Cotton, Tenn. Agr. Exp. Sta., Knoxville, Tenn.
3. (S) Eriophyidæ of New York. A monographic study.
   H. E. Hodgkiss, N. Y. Agr. Exp. Sta., Geneva, N. Y.
4. (A) Hog louse. Life history investigations as a basis for methods of control. Project for 1912–13.
   E. C. Cotton, Tenn. Agr. Exp. Sta., Knoxville, Tenn.

Coleoptera

5. (S) Wireworms; life history and means of control.
   W. P. Flint, Field Laboratory of Ill. State Entomologist, Springfield, Ill.
6. (S) White grubs; life history and means of control.
   W. P. Flint, Field Laboratory of Ill. State Entomologist, Springfield, Ill.
7. (S) Fleabeetles affecting corn.
   Assistant of S. A. Forbes, State Entomologist, Urbana, Ill.
8. (S) Rosechafer. Life history and means of control.
   F. Z. Hartzell, N. Y. Agr. Exp. Sta., Geneva, N. Y.
9. (S) Grape root-worm; life history, habits, and means of control.
   F. Z. Hartzell, N. Y. Agr. Exp. Sta., Geneva, N. Y.
10. (H & A) Round-headed apple-tree borer (*Saperda candida*); studies of life history and means of control.
    Paul Hayhurst, Ark. Agr. Exp. Sta., Fayetteville, Ark.
11. Oak tree borer.
    A. G. Ruggles, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

12. Elm tree-borer.

A. G. Ruggles, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

13. (S) *Polydrosus impressifrons;* life history and distribution of this newly imported species.

W. J. Schoene, N. Y. Agr. Exp. Sta., Geneva, N. Y.

14. (S) Fruit-tree bark-beetles (*Phleotribus liminaris* and *Scolytus rugulosus*). Observations and experiments in control.

Assistants of H. A. Gossard, Ohio Agr. Exp. Sta., Wooster, Ohio.

15. (A) Rice weevil (*Calandra oryza*); life history, economic relationship, injury and control.

W. E. Hinds and assistants, Ala. Agr. Exp. Sta., Auburn, Ala.

16. Corn bill-bug (*Sphenophorus venatus*).

C. S. Spooner, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

17. (A) *Sphenophorus callosus* and other injurious species of *Sphenophorus* in North Carolina. A complete biological study of the species injurious to corn in North Carolina and determination of methods of control.

R. I. Smith, N. C. Agr. Exp. Sta., West Raleigh, N. C.

18. (S) Plum curculio; study of life history and orchard tests of sprays. (In co-operation with Horticultural Dept. and fruit growers.)

T. J. Headlee, L. M. Peairs, and Rees Hillis, Kas. Agr. Exp. Sta., Manhattan, Kas.

19. Plum Curculio; life history study and methods of spraying.

A. G. Ruggles, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

20. Plum Curculio; life history studies and control measures.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Canada.

Diptera

21. (A) *Nematocera.* A study of the early stages of some Nematocerous diptera with special reference to economic species; ecology, morphology, and taxonomy.

O. A. Johannsen, Me. Agr. Exp. Sta., Orono, Me.

22. (H) Control of black-flies, deer-flies, and midges. Experiments in the control of these and similar pests in the mountainous resort region of New Hampshire with incidental life history studies.

W. C. O'Kane, N. H. Agr. Exp. Sta., Durham, N. H.

23. The sand fly and pellagra; to determine what part, if any, the sand fly has in the transmission of this disease. (Coöperation with State Board of Health.)

S. J. Hunter, and W. T. Emery, Univ. of Kas., Lawrence, Kas.

24. (S) Grape midge; life history, habits and means of control.

F. Z. Hartzell, N. Y. Agr. Exp. Sta., Geneva, N. Y.

25. (S) Gall midges; a monographic study of biology and taxonomy.

E. P. Felt, State Entomologist, Albany, N. Y.

26. (S) Hessian fly; field observations on abundance and measures of control.

H. A. Gossard and assistants, Ohio Agr. Exp. Sta., Wooster, Ohio.

27. (S) Hessian fly; life history, habits and means of control. (In coöperation with U. S. Bureau of Entomology.)

P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

28. (S) Narcissus fly (*Melodron equestris*); life history and control measures.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

29. (S) House-flies; a study of parasites, range of flight and general economic relations.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

30. (S) Root maggots; experiments in methods of control.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

31. (S) Cabbage maggot; studies of life history, habits, methods of control, physiological reactions of puparia to heat and dessication, and methods of protecting seed beds.

W. J. Schoene, N. Y. Agr. Exp. Sta., Geneva, N. Y.

32. (S) Apple maggot; life history and control measures.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

33. (A) Apple maggot (*Rhagoletis pomonella*). A thorough study of the life history, and measures of control.

W. C. O'Kane, N. H. Agr. Exp. Sta., Durham, N. H.

Hemiptera

34. (S) Green soldier-bug (*Nezara hilaris*); life history study and means of control in peach orchards.

Assistant of H. A. Gossard, Ohio Agr. Exp. Sta., Wooster, Ohio.

35. (S) False tarnished bug (*Lygus invitus* Say). The life history, habits, and methods of control of this pest of the pear.

H. E. Hodgkiss, N. Y. Agr. Exp. Sta., Geneva, N. Y.

36. (S) Chinch-bug; life history and means of control.

W. P. Flint, Springfield, Ill., and L. M. Smith, Carbondale, Ill.

Field laboratories of the Ill. State Entomologist.

37. (H) Chinch-bug investigations to discover practical means of control, based on careful life history studies.

T. J. Headlee, J. M. McColloch, and F. B. Milliken, Kas. Agr. Exp. Sta., Manhattan, Kas.

38. (S) Chinch-bug; field observations on abundance and measures of control.

H. A. Gossard and assistances, Ohio Agr. Exp. Sta., Wooster, Ohio.

39. (S) Grape leaf-hopper; life history, habits and means of control.

F. Z. Hartzell, N. Y. Agr. Exp. Sta., Geneva, N. Y.

40. Membracidæ; studies in development, morphology and embryology.

Hazel Branch, Univ. of Kas., Lawrence, Kas.

41. (A) *Psyllidæ*. Ecological studies and descriptions of *Psyllidæ* of New England.

Edith M. Patch, Me. Agr. Exp. Sta., Orono, Me.

42. (S) Pear psylla. To determine more efficient methods of control; attention is being given to the effects of the various elements of the environment on larval activities.

H. E. Hodgkiss and P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

43. (A) *Aphididæ*. Ecological studies of the *Aphididæ* of Maine.

Edith M. Patch, Me. Agr. Exp. Sta., Orono, Me.

44. (A & H) *Aphididæ*. Investigations of the *Aphididæ* of Colorado; studies of life histories, food plants and means of control.

C. P. Gillette and assistants, Colo. Agr. Exp. Sta., Fort Collins, Colo.

45. (H) The cotton or melon aphis (*Aphis gossypii*); life history, habits and means of control.

Wilmon Newell and assistants, Tex. Agr. Exp. Sta., College Station, Tex.

46. (A) Melon aphis (*Aphis gossypii*) parasites. Studies of the parasites of the melon aphis, their relative importance, other hosts, and possibility of artificially increasing these parasites.

L. Bruner and M. H. Swenk, Nebr. Exp. Sta., Lincoln, Nebr.

47. (S) Corn root-aphis; life history, habits and means of control.

W. P. Flint, field laboratory of Ill. State Entomologist, Springfield, Ill.

48. (H) Green-bug (*Toxoptera graminum*). An investigation of field spraying for incipient outbreaks; supplemental to project number 100.

T. J. Headlee and F. B. Milliken, Kas. Agr. Exp. Sta., Manhattan, Kas.

49. (A) Woolly aphis. A general study with special reference to its relation to other forms of the same species native in Arkansas and to the immunity of Northern Spy trees.

Paul Hayhurst, Ark. Agr. Exp. Sta., Fayetteville, Ark.

50. (S) Woolly aphis.

L. M. Smith, field laboratory of Ill. State Entomologist, Carbondale, Ill.

51. Woolly aphis; experience in methods of control on nursery stock.

H. B. Hungerford, Univ. of Kas., Lawrence, Kas.

52. (S) Woolly aphis.

E. L. Worsham, State Entomologist, Atlanta, Ga.

53. Woolly aphis; experiments with different solutions for control.

T. B. Symons and O. G. Babcock, Md. Agr. Exp. Sta., College Park, Md.

54. (S) Woolly aphis; spraying nursery stock. (Coöperation State Nursery Inspector.)

H. A. Gossard, Ohio Agr. Exp. Sta., Wooster, Ohio.

55. (A) Citrus white-fly; a study of its biology and measures of control. Study is now being given to determine the causes of natural mortality.

J. R. Watson, Fla. Agr. Exp. Sta., Gainesville, Fla.

56. (H) Scale insects of Texas.

Wilmon Newell and assistants, Tex. Agr. Exp. Sta., College Station, Tex.

57. (S) Fruit scales; life history studies and means of control.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

58. San José scale; methods of control.

A. J. Spangler, University of Kansas, Lawrence, Kas.

59. (S) San José scale; methods of control with lime sulphur wash, miscible oils and other sprays.

T. B. Symons, E. N. Corey, O. G. Babcock, Md. State Hort. Dept., College Park, Md.

60. (S) Terrapin scale; same as project 59.

Hymenoptera

61. (S) Larch sawfly (*Lygæonematus erichsonii*) and its parasites. European and North American parasites are being studied and an attempt is being made to introduce the latter from New England.

C. Gordon Hewitt, Div. Entomology, Dept. Agr., Ottawa, Can.

62. Larch sawfly.

A. G. Ruggles, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

63. (S) Cherry sawfly leaf-miner (*Profenusa collaris* Mac G.); life history, habits, and methods of control of this new cherry pest.

P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

64. *Bruchophagus funebris.*

Warren Williamson, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

65. Gall-forming insects of Kansas with special reference to *Cynipidæ.*

Roy Fraser, University of Kansas, Lawrence, Kansas.

66. (S) Wheat joint-worm; field observations on measures of control.

H. A. Gossard and assistants, Ohio Agr. Exp. Sta., Wooster, Ohio.

68. (A) *Opiinæ.* A monographic revision of this family of *Braconidæ* with special reference to its economic importance.

A. B. Gahan, Md. Agr. Exp. Sta., College Park, Md.

69. (A) Parasites. A study of native hymenopterous and dipterous parasites of certain Maine insects, with experiments in rearing and propagation.

O. A. Johannsen and Edith M. Patch, Me. Agr. Exp. Sta., Orono, Me.

70. (H & S) Ant control, especially *Pogonomyrmex barbata* and species of *Solenopsis;* tests of insecticides and repellents.

A. W. Morrill, Ariz. Agr. Exp. Sta., Phoenix, Ariz.

71. *Larridæ.* A study of the biology and taxonomy of Kansas *Larridæ.*

F. X. Williams, University of Kansas, Lawrence, Kas.

Lepidoptera

72. (A) Pine-tip moth (*Retinia frustrana*); life history and means of control.

L. Bruner and M. H. Swenk, Nebr. Agr. Exp. Sta., Lincoln, Nebr.

73. (S) Spruce budworm (*Tortrix fumiferana*) and its parasitic means of control in Quebec, Eastern Canada and British Columbia.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

74. Garden webworm; a study of distribution and control in Maryland, especially on alfalfa.

O. G. Babcock, Md. State Hort. Dept., College Park, Md.

75. (H) A study of the waxworm; life history, habits and methods of control.

Wilmon Newell and assistants, Tex. Agr. Exp. Sta., College Station, Tex.

76. (S) Ermine moths of apple and cherry. A study of life histories, habits, and distribution in New York of these imported insects.

P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

77. (S) Codling moth; studies of life history and means of control under the diverse conditions found in various parts of Arizona.

A. W. Morrill, Ariz. Hort. Comm. and Agr. Exp. Sta., Phoenix, Ariz.

78. (H) Codling moth; investigations of life history and means of control.

G. P. Weldon, Colo. Agr. Exp. Sta., Fort Collins, Colo.

79. (S) Codling moth; a study of spray efficiency.

E. P. Felt, State Entomologist, Albany, N. Y.

80. (S) Codling moth. A study of life history and orchard tests of sprays. (Coöperation of Department of Horticulture and fruit growers.)

T. J. Headlee, L. M. Peairs, and Rees Hillis, Kas. Agr. Exp. Sta., Manhattan, Kas.

81. (S) Codling moth; life history and means of control.

E. L. Worsham, State Entomologist, Atlantic, Ga.

82. (A) Peach tree borer. A study of the life history so as to secure exact information as to its relation to environmental conditions in Tennessee as a basis for developing a rational method of control.

E. C. Cotton, Tenn. Agr. Exp. Sta., Knoxville, Tenn.

83. (H & A) Peach tree borer; studies of life history and means of control.

Paul Hayhurst, Ark. Agr. Exp. Sta., Fayetteville, Ark.

84. (H) Peach tree borer; life history, habits, and methods of control.

Wilmon Newell and assistants, Tex. Agr. Exp. Sta., College Station, Tex.

85. Peach tree borer; life history and means of control.

T. B. Symons and E. N. Corey, Md. State Hort. Dept., College Park, Md.

86. Peach tree borer; life history studies and means of control.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

87. Cutworms; life history studies and means of control.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

88. Corn budworm (? *Heliothis obsoleta* Fab.); experiments in control.

Franklin Sherman, Jr., State Entomologist, Raleigh, N. C.

89. Corn earworm (*Heliothis obsoleta* Fab.). A study of the life history and methods of control on corn and garden truck.

T. J. Headlee, J. W. McColloch, Kas. Agr. Exp. Sta., Manhattan, Kas.

90. Browntail moth. A study of parasites and influence of local and other conditions.

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

Orthoptera

91. (H) Walking sticks (*Diaphereomera femorata*); experiments in control.

W. E. Rumsey, W. Va. Agr. Exp. Sta., Morgantown, W. Va.

92. (H & S) Grasshopper investigations; studies of life histories of Colorado species, food plants, and remedial measures.

S. A. Johnson, Colo. Agr. Exp. Sta., Fort Collins, Colo.

93. (S) Grasshopper control; studies of poisoning, cultivation, mechanical contrivances, and artificial spread of fungous diseases.

L. Bruner, Nebr. Agr. Exp. Sta., Lincoln, Nebr.

94. Grasshopper control.

F. L. Washburn, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

95. (S) Mole cricket (*Scapteriscus didactylus*). (In coöperation with Ga. Agr. Exp. Station.)

E. L. Worsham, State Entomologist, Atlanta, Ga.

96. (S) Tree crickets. A study of the life histories, habits, and methods of control of *O. niveus* and related species.

P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

Thysanoptera

97. (S) Thrips in cereals. The species around Ottawa are being studied as various species are present throughout Canada

C. Gordon Hewitt, Div. Entomology, Can. Dept. Agr., Ottawa, Can.

98. (S) Pear thrips (*Euthrips pyri* Daniel); life history, habits, distribution in New York and methods of control.

P. J. Parrott, N. Y. Agr. Exp. Sta., Geneva, N. Y.

99. (H & S) Orange thrips. Investigation of injury, seasonal history and method of control in Salt River Valley.

A. W. Morrill, Ariz. Hort. Comm. and Agr. Exp. Sta., Phoenix, Ariz.

General Subjects

100. (A & S) Investigations to determine the bearing of climatic factors upon the life economy of the Hessian fly and plant lice injurious to wheat and corn, including determination of maximum, optimum, and minimum conditions of temperature, moisture, sunlight, food supply, etc.

T. J. Headlee and student assistants, Kas. Agr. Exp. Sta., Manhattan, Kas.

101. A study of the influence of temperature and moisture on insect development.

Ruby Hosford, University of Kansas, Lawrence, Kas.

102. (S) Breeding investigation. An investigation to extend the knowledge of the laws of hybridization and to discover how to disturb the mechanism of transmission of characters so that new species may be produced. *Tettiginæ* used for material.

R. K. Nabours and student assistants, Kas. Agr. Exp. Sta., Manhattan, Kas.

103. (A) A study of inheritance of the honey-bee.

Wilmon Newell, Harper Dean and F. B. Paddock, Tex. Agr. Exp. Sta., College Station, Tex.

104. (S) Shade and forest tree insect investigations; with special attention to the elm leaf-beetle.

E. P. Felt, State Entomologist, Albany, N. Y.

105. (S) Park and truck garden insect investigations,

D. K. McMillan, Field laboratory of Ill. State Entomologist, Chicago, Ill.

106. (S) Insect Pests of alfalfa. Data is being gathered for a monographic treatment of this subject, which includes general collecting and life history studies.

L. Bruner, M. H. Swenk and assistants, Lincoln, Nebr.

Incidental to Insect Control

107. (A) The use of carbon disulphide and hydrocyanic acid gases as insecticide fumigants.

W. E. Hinds and assistants, Ala. Agr. Exp. Sta., Auburn, Ala.

108. (A) Control of root maggots. An investigation of the means of control of soil-inhabiting insects, including rate and extent of diffusion of gases and liquid insecticides in various types of soils, and their effect on animal and plant life.

W. C. O'Kane, N. H. Agr. Exp. Sta., Durham, N. H.

109. (A) A study of the physiological effect of lead arsenate on weevils of the order *Rhyncophora*.

Wilmon Newell, Harper Dean, and F. B. Paddock, Tex. Agr. Exp. Sta., College Station, Tex.

110. (S) Effect of dipping nursery stock in various insecticides to determine the influence on the trees and on the insects.

T. B. Symons and E. N. Corey, Md. State Hort. Dept., College Park, Md.

111. (S) Spraying apples to determine exact limitations of different insecticides in practical use on some 200 acres of orchards in various parts of Ohio; largely demonstrational. (In coöperation with horticultrual and botanical departments.)

H. A. Gossard and assistants, Ohio Agr. Exp. Sta., Wooster, Ohio.

112. (S) Spraying peaches, plums and cherries on 50 acres of orchards in various parts of Ohio to determine methods of control of insects and diseases in practical orchard operations; largely demonstrational. (In coöperation with horticultural and botanical departments.)

H. A. Gossard, and assistants, Ohio Agr. Exp. Sta., Wooster, Ohio.

113. Experiments to determine the effect of some commonly used sprays on the apple.

S. J. Hunter, A. T. Walker, and A. J. Spangler, University of Kansas, Lawrence, Kas.

114. (S) Lime-sulphur and other preparations with lead arsenate compared with Bordeaux mixture. (In coöperation with Botanical department.)

W. E. Britton, Conn. Agr. Exp. Sta., New Haven, Conn.

115. Effect of arsenical sprays on stock.

C. S. Spooner, Minn. Agr. Exp. Sta., St. Anthony Park, Minn.

116. (S) Study of spraying machinery.

Assistants of H. A. Gossard, Ohio Agr. Exp. Sta., Wooster, Ohio.

117. (S) Experiments in comparative efficiency of treatment of mills and granaries by heat and hydrocyanic acid gas, with life history studies of granary pests.

Assistants of H. A. Gossard, Ohio Agr. Exp. Sta., Wooster, Ohio.

118. (A) Stored grain and mill insect investigations, to discover practical methods of control, with life history studies.

Geo. A. Dean and student assistants, Kas. Agr. Esp. Sta., Manhattan, Kas.

VACATION NOTES IN THE ADIRONDACKS

By W. E. Britton, *New Haven, Conn.*

It was the writer's good fortune to spend two weeks of his vacation, July 8 to July 22, 1911, in the town of Jay, Essex County, N. Y., at an altitude of over 1,000 feet. The following entomological observations were made there, and most of the species herein mentioned were collected.

Acres of alders on the hillsides and along streams had been defoliated by the alder flea-beetle, *Haltica bimarginata* Say (=*alni* Harr.). In some cases the bushes were bare, but usually the network of the leaves still remained, and turning brown gave them the appearance of having been scorched by fire. The adult is one of the largest species of the genus *Haltica*, is dark blue and with a longitudinal fold on the outer margins of the wing covers.

Another and smaller flea-beetle, *Phyllodecta vittellinæ* Linn. (=*vulgatissima* Linn.) was feeding upon the terminal leaves of low-growing willows along the banks of the Ausable River.

The forest tent caterpillar, *Malacosoma disstria* Hubn., had evidently been quite abundant earlier in the season, as the separate empty cocoons were present on the trunk of nearly every tree, including pines, and on fences and stone walls. On the under side of large branches of apple trees one could see patches five or six inches in diameter of the cast skins or molts of the caterpillars. These trees also showed that considerable eating had been done by the caterpillars earlier in the season before the trees had ceased growing.

The underbrush in the pine woods, near the writer's cabin, was commonly infested by a soft scale, probably *Lecanium corni* Bouché. The brown empty shells were still clinging to the twigs, and the young were well established along the veins of the leaves as well as on the bark of the twigs. Many twigs and some small bushes had already been killed by this insect, which was noticed on elm, hazel, hop hornbeam or ironwood, sugar maple, yellow birch, paper birch, choke cherry, black cherry and bird or pigeon cherry.

Oyster shell scale was abundant, and one scrub apple in a pasture had been killed outright by it.

In climbing Mount Wainwright (one of the lesser peaks) I noticed a paper birch which had been attacked by the bronze birch borer, *Agrilus anxius* Gory, the spiral ridges caused by the tunneling of the larvæ showing prominently on the upper branches.

In the fields and pastures the grass was being destroyed by hordes

of grasshoppers, the most abundant species seemingly being *Camnula pellucida* Scudd.

Collecting in this region was especially poor because of the extreme drought, which was the most severe in the memory of the oldest residents. In the Lepidoptera, the Mourning Cloak, *Euvanessa antiopa* Linn. and the Compton Tortoise *Grapta j-album* Boisdv. & Lec., *Hadena arctica* Boisdv. and *Epizeuxis lubricalis* Geyer were very common in the pine woods around the cabins. The imported cabbage butterfly *Pontia (Pieris) rapæ* Linn. and *P. napi* Linn. were both rather abundant. *Polygonia faunus* Edw. and *P. progne* Cram. flitted about the cabin among the pine trees, and a few specimens were taken. The rarest capture, perhaps, was a perfect female specimen of *Plusia balluca* Geyer, which was brought to me one day by the landlady, who found it in the house. I afterwards found a fresh wing of the same species at the foot of a large pine, showing that tragedies occur in entomology.

Five specimens of *Caripeta angustiorata* Walk. and one of *C. divisata* Walk. were taken, and amongst the lot are several small geometrids, some of which have not yet been identified. Few noctuids were collected.

In the Diptera, which were mostly common species, there was a single example each of *Dasyllis posticata* Say and *Psilocephala rufiventris* Loew.

In the Coleoptera *Leptura canadensis* Oliv. was common flying about in the pine woods, and *Typocerus velutinus* Oliv. was abundant on flowers of *Spiræa salicifolia*. One example of *Cicindela longilabris* Say was captured. One specimen each of *Buprestis maculiventris* Say, *Corymbites æripennis* Kirby, and a female specimen of *Odontæus obesus* LeC., the latter originally described from California, were kindly identified for me by Mr. C. A. Frost.

A number of interesting insects in other orders were also collected, but many of these are still undetermined.

Elm Leaf Beetle (*Galerucella luteola* Mull.). This pest has been excessively abundant and destructive the past season on Long Island, throughout the Hudson valley and in other sections of the state where it has become established. The elms in many villages were so seriously affected that practically all the leaves were destroyed by midsummer. This serious injury also occurred on groups of elms or even roadside trees in the country. It is undoubtedly true that the damage was greatly accentuated by drought, yet it seems very probable that automobiles and trolley cars have been important factors in distributing an otherwise local though very prolific insect and, as a consequence, are indirectly responsible.

E. P. Felt.

NEW SPECIES OF GALL MIDGES

By E. P. Felt, *Albouy, N. Y.*

(*Continued from page 484*)

Leptosyna quercus n. sp. *Male.* Length 9 mm. Antennæ extending to the third abdominal segment, rather thickly haired, pale yellowish; 13 segments, the fifth with a stem about three fourths the length of the subcylindric basal enlargement, which latter has a length one fourth greater than its diameter, is distinctly swollen subapically and bears a rather thick subapical band of long, stout setæ; twelfth segment subcylindric, slightly expanded and with a length nearly twice its diameter, the thirteenth slightly fused with the preceding, subcylindric, apically a short, stout knob. Palpi uniarticulate, the one segment with a length about two and one half times its diameter, tapering. Mesonotum shining reddish brown. Scutellum and postscutellum pale orange. Abdomen mostly pale whitish yellow, yellowish basally, the genitalia fuscous. The very narrow wings hyaline, with a thick fringe, the latter having a length about half the width of the wing; subcosta unites with costa near the basal half; the nearly straight third vein extends toward the apex of the wing, becoming obsolete at the distal fifth; the simple fifth vein joins the posterior margin near the basal half; each vein with sparse, long setæ. Halteres pale yellowish, reddish orange apically. Legs a nearly uniform pale straw, rather thickly haired. Anterior metatarsus with a length two and one-half times its diameter, the second segment twice the length of the first, the third about three fourths the length of the second, the fourth three fourths the length of the third and the fifth one half longer than the fourth. Claws slender, evenly curved, simple, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, stout, obliquely truncate; terminal clasp segment long, greatly swollen apically, a distinct spur; dorsal plate short, broadly and roundly emarginate, the lobes broadly rounded, chitinized, setose; ventral plate long, broad, broadly rounded.

Reared from decaying red oak bark taken at Nassau, N. Y. Type C. a2108.

Asphondylia eupatorii n. sp. *Male.*—Length 3 mm. Antennæ light brown; fourteen segments. Palpi; the first segment is irregular, with a length about twice its diameter, the second long, tapering distally and with a length fully five times its diameter. Mesonotum dark brown. Scutellum and postscutellum probably fuscous yellowish. Abdomen dark brown, thickly clothed with light hairs. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Legs; coxæ and the basal two thirds of femora yellowish, the distal portion of femora, tibiæ and tarsi dark brown, except the yellowish tibiæ, narrowly fuscous apically, of the posterior legs, while the first tarsal segments and the basal three fourths of the second are silvery white. Genitalia; basal clasp segment greatly swollen; terminal clasp segment short, stout, bidentate; dorsal plate divided, the lobes irregularly orbicular, sparsely setose; ventral plate deeply and triangularly incised, the lobes irregularly rounded and sparsely setose.

Female.—Length 4.5 mm. Antennæ dark brown, the third segment having a length about six times its diameter, the terminal segment globose. Other characters practically as in the male.

Reared by L. H. Weld of Illinois from a green, fleshy, stem gall on white snake root, *Eupatorium urticæfolium* collected at Medina, N. Y. Allied to *A. helianthiflorœ* Felt. Type C. 1288.

Asphondylia thalictri n. sp. *Male.*—Length 3 to 3.5 mm. Antennæ dark brown; fourteen segments, the third with a length about five times its diameter, the terminal segment reduced, with a length about two and one half times its diameter and tapering to a conical apex. Palpi; first segment subquadrate, the second with a length about four times its diameter, rather stout, the third one fourth longer than the second, more slender. Mesonotum a dark or slaty brown. Scutellum yellowish brown, postscutellum reddish brown. Abdomen dark brown, rather thickly clothed with pale yellowish hairs. Genitalia fuscous. Wings hyaline, costa light straw. Halteres yellowish basally, fuscous or reddish brown apically. Coxæ and femora basally pale straw, the distal portion of femora and tibiæ a fuscous straw, the tarsi a little darker. Claws rather stout, strongly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, terminal clasp segment short, greatly swollen, bidentate; dorsal plate short, divided, the lobes broadly orbicular and coarsely setose; ventral plate narrowly divided, the lobes narrowly triangular and thickly setose; style short, stout.

Reared from distorted seed capsules of Thalictrum collected by Miss Cora H. Clarke, Magnolia, Mass. Allied to *A. hydrangeæ* Felt. Type C. a2211.

Bruggmanniella mexicana n. sp. *Male.*—Length 2 mm. First antennal segment slightly obconic, with a length twice its diameter, the second subcylindric, with a length a little less than its diameter, other segments missing. Palpi; first segment irregularly triangular, the second rectangular, with a length over three times its width, the third a little longer and more slender than the second. Mesonotum reddish brown, the submedian lines slaty, sparsely haired. Scutellum yellowish, brownish subapically, sparsely haired; postscutellum reddish brown. Abdomen rather thickly haired, dark brown. Wings rather thickly haired, hyaline, except for the rather fuscous subcostal cell; costa yellowish brown, subcosta uniting therewith at the basal third, the third vein at the apex, the fifth at the distal fourth, its branch near the basal half. Halteres yellowish transparent; slightly fuscous subapically. Coxæ fuscous yellowish, the anterior femora and tibiæ mostly dark brown, the tarsi yellowish brown; the middle and posterior femora yellowish brown, with the distal fourth fuscous; the posterior tibiæ dark brown, the posterior tarsi with the first segment white and the second to fifth yellowish; claws rather long, slender, slightly curved, simple, the pulvilli rudimentary. Genitalia; basal clasp segment greatly swollen, stout as in Asphondylia; terminal clasp segment short, stout as in Asphondylia but with the heavily chitinized apex pectinate; dorsal plate short, emarginate, the lobes broadly rounded, other organs indistinct.

Reared from an irregular stem gall on wait-a-bit, probably *Pisonia aculeata* collected by Dr. E. A. Schwarz at Tampico, Mexico. Type C. a2119.

Contarinia spiraeina n. sp. *Male.*—Length 1.25 mm. Antennæ yellowish brown; fourteen segments, the fifth having the basal portion of the stem with a length one fourth greater than its diameter, the distal part with a length two and one fourth

times its diameter; each enlargement subglobose, with a sparse subbasal whorl of moderately stout setæ and a circumfilum, the loops of the latter rather stout and extending to the succeeding enlargement; terminal segment having the basal portion of the stem with a length about twice its diameter, the distal enlargement produced, fusiform, with a length about twice its diameter. Palpi; first segment stout, swollen distally, second rectangular, with a length nearly three times its diameter, the third one third longer than the second, more slender, the fourth one fourth longer than the third, somewhat dilated. Mesonotum slaty brown. Scutellum reddish, thickly setose; postscutellum reddish brown. Abdomen sparsely setose, a nearly uniform yellowish red. Wings hyaline, costa yellowish brown, the third vein uniting with the margin just beyond the apex of the wing. Halteres reddish brown, yellowish apically. Coxæ slaty brown; femora, tibiæ and tarsi reddish yellow, the femora and tibiæ somewhat darker apically; claws slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment moderately stout; terminal clasp segment stout, moderately long; dorsal plate short, triangularly emarginate, the lobes broadly rounded, setose; ventral plate deeply and triangularly emarginate, the lobes slender and narrowly rounded apically; style short, tapering, subacute.

Female.—Length 1.5 mm. Antennæ dark brown; fourteen subsessile segments, the fifth having a stem about one sixth the length of the subcylindric basal enlargement, which latter has a length two and one half times its diameter, and a thick subapical band of short, stout setæ; circumfili well developed, rather high; terminal segment cylindric, with a length nearly three times its diameter and tapering to a narrowly rounded apex. Palpi; nearly as in the male. Mesonotum slaty brown, the yellowish submedian lines thickly setose. Scutellum reddish brown, thickly setose; postscutellum reddish brown. Abdomen sparsely setose, the dorsal sclerites dark reddish brown, the venter reddish orange. Halteres yellowish brown. Coxæ slaty brown. Legs mostly yellowish brown, the tibiæ and tarsi somewhat darker apically. The slender ovipositor one half longer than the body; terminal lobes with a length six times the width, subacute, sparsely setose.

Reared from cabbage-like, bud galls on Spiraea collected by Miss Cora H. Clarke, at Magnolia, Mass. Type C. a2142.

Dicrodiplosis coccidarum n. sp. *Female.*—Length 1.5 mm. Antennæ dark brown; probably fourteen segments, the fifth with a stem about one fourth the length of the cylindric basal enlargement, which latter has a length about one half greater than its diameter, a thick subapical band of shorter, fine setæ. The circumfili are unusual in that the basal filum bends strongly towards the apex of the segment and in some instances anastomoses irregularly, the distal circumfili has rather high loops. Palpi; first segment subquadrate, the second narrowly oval, the third rectangular, with a length nearly three times its diameter, the fourth fusiform and about as long as the third. Mesonotum dark brown, the submedian lines indistinct. Scutellum reddish brown, postscutellum yellowish. Abdomen sparsely haired, dark brown. Wings hyaline, costa pale yellowish, subcosta uniting therewith before the basal half, the third vein at the apex, the fifth at the distal fourth, its branch near the basal half. Legs a variable yellowish transparent, the middle claw at least stout, strongly curved, unidentate, the pulvilli about half the length of the claws. Ovipositor short, the terminal lobes narrowly oval, with a length about twice the width and thickly setose.

Presumably reared from a scale insect by August Busck and labeled

Diplosis coccidarum Mayaguez, Porto Rico. Loaned for study by U. S. National Museum. Type C. 970.

Dicrodiplosis gillettei n. sp. *Female.*—Length nearly 2 mm. Antennæ dark brown, yellowish basally; fourteen segments, the fifth with a stem one fourth the length of the cylindric basal enlargement, which latter has a length about thrice its diameter; terminal segment apically with a short, stout process. Palpi; first segment subquadrate, the second with a length about three times its diameter, the third a little longer, more slender, the fourth a little longer than the third and somewhat dilated. Mesonotum slaty brown, the submedian lines reddish orange. Scutellum brownish red, postscutellum dark brown. Abdomen reddish salmon. Wings hyaline. Costa, light straw. Halteres yellowish basally, reddish apically. Coxæ dark reddish, the femora mostly pale straw; tibiæ fuscous straw, the tarsi slightly darker. Claws slender, strongly curved, unidentate, the pulvilli a little longer than the claws. Ovipositor short, the terminal lobes with a length about three times the width, sparsely setose.

Reared from an apical, bud-like deformity on *Pinus scopulorum.* collected by Prof. C. P. Gillette, Fort Collins, Col. Allied to *D. rubida* Felt. Type C. a2205.

Mycodiplosis carolina n. sp. *Male.*—Length 1.25 mm. Antennæ pale yellowish; fourteen segments, the fifth having the basal portion of the stem with a length thrice its diameter, the distal part with a length three and one half times its diameter; basal enlargement subglobose, subbasal whorl rather thick, the circumfilum with long loops extending to the produced distal enlargement, which latter has a length one half greater than its diameter, a sparse whorl of long setæ and subbasal and subapical circumfili, the loops of the last extending to the apex of the segment; terminal segment produced, the basal portion of the stem with a length five times its diameter, the distal enlargement cylindric, with a length nearly four times its diameter and apically a long, slender, finger-like process. Palpi; first segment irregularly subquadrate, the second fusiform, with a length over three times its diameter, the third one half longer than the second, more slender, the fourth a little longer than the third, more slender. Body pale yellowish. Wings yellowish, costa light brown, the third vein uniting with the margin well beyond the apex. Halteres yellowish transparent. Legs pale yellowish; claws slender, strongly curved, the anterior and mid unidentate, the pulvilli shorter than the claws. Genitalia; basal clasp segment rather stout, truncate; terminal clasp segment long, swollen basally; dorsal plate rather short, broad, triangularly emarginate, the lobes broadly and roundly emarginate; internal and external angles slightly produced, subequal and sparsely setose; ventral plate long, expanded apically, broadly rounded and finely setose. Harpes short, subtriangular; style long, tapering, narrowly rounded apically.

Reared by Theodore Pergande from leaves of *Lilium superbum* received from H. P. Kelsey, Kawani, N. C. Loaned for study by the U. S. Bureau of Entomology. Allied to *M. robusta* Felt. Type C. 976.

Mycodiplosis coccidivora n. sp. *Male.*—Length 1 mm. Antennæ missing. Mesonotum light brown. Scutellum and postscutellum yellowish brown. Abdomen

reddish brown. Wings hyaline, costa dark brown, the third vein uniting with the margin at the apex of the wing. Halteres pale yellowish. Legs mostly a fuscous yellowish, the distal tarsal segments somewhat darker; claws rather stout, strongly curved, the anterior unidentate, the pulvilli rudimentary. Genitalia; basal clasp segment stout, with a length only a little over twice its diameter; terminal clasp segment short and relatively stout; dorsal plate short, broad, deeply and triangularly incised, the lobes narrowly rounded and sparsely setose; ventral plate moderately long, broad, broadly rounded or slightly truncate distally and sparsely setose.

Female.—Length 1 mm. Antennæ reddish brown, the basal segments yellowish; fourteen segments, the fifth with a stem one third the length of the cylindric basal enlargement, which latter has a length about one half greater than its diameter, is slightly swollen near the middle, subbasal whorl sparse, a thick subapical band of long, curved setæ. Palpi; first segment subquadrate, with a length one fourth greater than its width, the second irregularly suboval, the third one half longer than the second, slightly expanded distally, the fourth about as long as the third, more slender. Face yellowish; eyes black. Mesonotum reddish brown, the submedian lines indistinct, yellowish brown. Scutellum and postscutellum yellowish. Abdomen reddish brown, the basal segment and the second segment laterally yellowish. Wings hyaline, with violaceous reflections in certain lights. Halteres yellowish. Coxæ and femora basally pale straw, the femora distally, tibiæ and tarsi mostly reddish brown; claws moderately stout, strongly curved, the anterior unidentate, the pulvilli rudimentary. Ovipositor short, the terminal lobes narrowly oval, with a length nearly twice the width.

Reared by Prof. T. D. A. Cockerell from the ovisac of *Pulvinaria urbicola* taken on capsicum at Kingston, Jamaica, W. I. and labeled *Diplosis coccidarum* Ckll. This is very different from what we take to be the true *Diplosis coccidarum* Ckll., a species reared from Dactylopius. Type C. 969.

Mycodiplosis cucurbitae n. sp. *Female.*—Length 1 mm. Antennæ light brown; fourteen segments, the fifth with a stem one third the length of the cylindric basal enlargement, which latter has a length two and one half times its diameter; subbasal whorl sparse, subapical band sparse, the setæ strongly curved; terminal segment produced, the basal enlargement with a length four times its diameter. Apically there is a long, finger-like process, the latter swollen basally. Palpi; first segment subquadrate, the second narrowly oval, with a length fully twice its diameter, the third as long as the second and the fourth a little longer and more slender than the third. Mesonotum yellowish brown, the submedian lines, scutellum and postscutellum yellowish. Abdomen yellowish brown, thickly haired. Wings hyaline, costa light straw, the third vein uniting with the margin beyond the apex. Halteres whitish transparent. Legs a variable yellowish brown, the distal tarsal segments darker; claws very long, slender, evenly curved, the anterior and mid unidentate, the tooth long and slender. Ovipositor short, the terminal lobes narrowly oval and sparsely setose.

Reared by the late C. V. Riley from orange larvæ on a squash having a curious rough, fulvous appearance. Loaned for study by the U. S. Bureau of Entomology. Type C. 966a.

Mycodiplosis spinosa n. sp. *Male.*—Length .9 mm. Antennæ light brown; fourteen segments, the fifth having the basal portion of the stem with a length twice

its diameter, the distal part with a length two and one half times its diameter; basal enlargement subglobose, with a sparse subbasal whorl of stout setæ and a subapical circumfilum, the loops hardly extending beyond the tip of the swelling, the distal enlargement with a length one half greater than its diameter, a rather thick whorl of slender setæ and subbasal and subapical circumfili, the loops of the latter extending to the apex of the segment. Palpi; first segment subquadrate, the second with a length three times its diameter, the third a little longer than the second, more slender, the fourth a little longer than the third, somewhat dilated. Mesonotum reddish brown, the submedian lines yellowish. Scutellum yellowish, postscutellum yellowish brown. Abdomen rather thickly haired, dark reddish brown. Wings hyaline, costa light brown, the third vein uniting with the margin a little before the apex. Halteres whitish transparent. Femora and tibiae a light straw, the tarsi mostly light brown, the distal segments somewhat darker; claws long, slender, evenly curved, the anterior and mid probably unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender, truncate; terminal clasp segment rather long and slender; dorsal plate short, deeply and triangularly emarginate, the lobes triangular and sparsely setose; ventral plate long, broad, broadly truncate and sparsely setose apically. Harpes rather stout, tapering, coarsely spined apically; style long, tapering to a narrowly rounded apex.

Female.—Length 1 mm. Antennæ light brown; fourteen segments, the fifth having a stem one fourth the length of the cylindric basal portion, which latter has a length two and one half times its diameter and sparse subbasal and subapical whorls of stout setæ. Palpi probably as in the male. Mesonotum yellowish brown. Scutellum yellowish, postscutellum yellowish brown. Abdomen reddish brown, the basal segments yellowish. Ovipositor short, terminal lobes narrowly lanceolate, with a length fully twice the width, thickly setose.

Reared from oats without any indication as to locality or date. Loaned for study by the U. S. Bureau of Entomology. Type C. 955.

Youngomyia quercina n. sp. *Male.*—Length 2 mm. Antennæ reddish brown; fourteen segments, the fifth trinodose, the two portions of the stem, each with a length about two and one half times the diameter; basal enlargement subglobose, with a thick subbasal whorl of long, stout setæ and a subapical circumfilum, the loops extending nearly to the base of the distal enlargement, which latter is deeply though narrowly constricted near the basal third, has subbasal and subapical whorls of long, stout setæ and similar circumfili, the loops of the distal circumfilum extending to the tip of the segment; terminal segment greatly produced, the basal portion of the stem with a length six times its diameter, the distal enlargement greatly produced, strongly constricted near the basal third, and apically with a long, finger-like process with a length fully six times its diameter and but slightly swollen basally. Palpi; first segment subquadrate, the second with a length five times its diameter, the third and fourth more slender, each a little shorter than the second. Mesonotum light yellowish red. Scutellum and postscutellum pale yellowish. Abdomen sparsely haired, a variable yellowish brown, the distal segments somewhat darker. Wings hyaline, costa light brown. Halteres pale yellowish. Legs a nearly uniform light brown; claws stout, strongly curved, unidentate, the pulvilli about two thirds the length of the claws. Genitalia; basal clasp segment short, stout, truncate, the basal lobe rounded; terminal clasp segment one half longer than the basal, long, stout, curved; dorsal plate broadly and triangularly emarginate, the lobes sparsely setose internally; ventral plate rather short, stout, broadly rounded and thickly setose apically. Harpes thickly setose; style long, stout, expanded distally.

Reared by Theodore Pergande from lobulate leaf galls on running oak, *Quercus pumila* collected by Mr. Koeble at Donner, Cal. Loaned for study by the U. S. National Museum. Type C. 1009.

Youngomyia vernoniae n. sp. *Male.*—Length 2 mm. Antennæ pale yellowish; fourteen segments, the flagellate ones trinodose, the fifth having the basal portion of the stem with a length one half greater than its diameter, a well marked constriction in the middle of the distal enlargement, its length being half its diameter, while the distal portion of the stem has a length two and one half times its diameter; basal enlargement globose, with a sparse subbasal whorl of stout setæ and a rather slender circumfilum, the loops extending to the base of the distal enlargement, which latter has subbasal and subapical circumfili, the loops of the latter extending to the apex of the segment; terminal segment greatly produced, the basal portion of the stem with a length five times its diameter, the constriction of the distal enlargement with a length one half greater than its diameter; apically there is a long, finger-like process with a length six times its diameter. Palpi; first segment irregularly oval, the second longer than the first, dilated apically, the third and fourth subequal, slender. Mesonotum pale yellowish brown. Scutellum, postscutellum and abdomen yellowish brown, the last with the third and fourth segments dark brown; genitalia yellowish. Wings hyaline, costa light brown. Halteres yellowish transparent. Legs a nearly uniform yellowish straw; claws stout, rather strongly curved, the anterior unidentate, the pulvilli about half the length of the claws. Genitalia; basal clasp segment stout, truncate distally; terminal clasp segment one half longer, rather slender, curved; dorsal plate broadly and triangularly emarginate, the lobes thickly clothed internally with stout, tapering setæ; ventral plate long, broadly rounded apically and thickly clothed distally with stout, tapering setæ; style long, stout, expanded distally.

Female.—Length 2.5 mm. Antennæ light fuscous; fourteen segments, the fifth with a stem one fourth the length of the subcylindric basal enlargement, which latter has a length about three and one half times its diameter; terminal segment produced, the basal enlargement subcylindric, with a length nearly five times its diameter and apically a long, slender, finger-like process, swollen basally. Palpi; first segment with a length nearly three times its diameter, the second about twice the length of the first, the third and fourth subequal. Mesonotum light reddish brown. Scutellum pale yellowish; postscutellum yellowish brown. Abdomen rather thickly haired, dark yellowish brown. Wings with costa pale yellowish. Halteres yellowish transparent. Legs a nearly uniform light yellowish brown. Ovipositor short; terminal lobes large, suborbicular, thickly clothed with short, stout setæ.

Reared from blossoms of *Vernonia noveboracensis* collected in Virginia and loaned for study by the U. S. National Museum. Type C. 973.

Hyperdiplosis fungicola n. sp. *Male.*—Length 1 mm. Antennæ yellowish white; fourteen segments, the fifth having the basal portion of the stem with a length nearly three times its diameter, the distal part with a length about two and one half times its diameter; basal enlargement subglobose, subbasal whorl rather sparse, the subapical circumfilum with loops extending nearly to the base of the produced distal enlargement, which latter has a length about one half greater than its diameter, a sparse whorl of stout setæ, subbasal and subapical circumfili, the loops

of the latter extending nearly to the apex of the segment; terminal segment produced, the basal portion of the stem with a length about five times its diameter, the distal enlargement cylindric with a length about three times its diameter and apically with a finger-like process. Palpi; first segment irregularly subquadrate, the second with a length more than twice the first, the third as long as the second, the fourth a little longer than the third. Mesonotum yellowish brown. Scutellum and postscutellum a pale yellowish. Abdomen yellowish white, sparsely haired. Wings whitish, costa yellowish white, the third vein uniting with the margin well beyond the apex. Halteres whitish transparent. Legs yellowish white, the distal tarsal segments a light straw; claws long, slender, very strongly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment long, truncate; terminal clasp segment short, tapering from a swollen base; dorsal plate short, deeply and triangularly incised, the lobes truncate, with the lateral angles slightly produced, they and the internal angles sparsely setose; ventral plate long, very deeply and roundly emarginate, the slender lobes diverging and sparsely setose; style long, curved, narrowly rounded apically.

Reared from larvae on the surface of a nearly rotten fungous affected nectarine received at the Bureau of Entomology from Mrs. R. B. Tenney, Washington, D. C. Type C. 977.

Parallelodiplosis clarkeæ n. sp. *Male.*—Length 1.5 mm. Antennæ fuscous yellowish, yellowish basally; fourteen segments, the fifth having the basal portion of the stem with a length two and one half times its diameter, the distal part with a length three and one half times its diameter; basal enlargement globose, with a sparse subbasal whorl of stout setæ and a subapical circumfilum, the stout loops extending to the distal enlargement, which latter has a length one half greater than its diameter, a sparse whorl of setæ and basal and subapical circumfili, the loops of the former extending beyond the apex of the enlargement, those of the latter a little beyond the tip of the segment; terminal segment with the distal enlargement cylindric, with a length about two and one half times its diameter and a finger-like process apically. Palpi yellowish; first segment subquadrate, the second with a length about twice that of the first, the third as long as the second, the fourth about one half longer than the third. Mesonotum fuscous yellowish. Scutellum and postscutellum a little darker. Abdomen a fuscous yellowish, the genitalia darker. Costa light straw, the third vein joining the margin well beyond the apex of the wing. Halteres yellowish basally, slightly fuscous apically. Legs mostly a fuscous straw; claws rather stout, strongly curved, slightly swollen near the middle, the pulvilli about one half the length of the claws. Genitalia; basal clasp segment rather long, stout, truncate, terminal clasp segment long, curved; dorsal plate short, broad, triangularly incised, the lobes broad, broadly and deeply emarginate, the produced angles with stout setæ apically; ventral plate long, rather broad, broadly and roundly emarginate. Style long, slender, broadly rounded distally.

Female.—Length 1.75 mm. Antennæ fuscous yellowish, yellowish basally; fourteen segments, the fifth with a stem about three fourths the length of the cylindric basal enlargement, which latter has a length thrice its diameter, a scattering subapical band of long, stout setæ; terminal segment produced, the cylindric basal portion with a length fully five times its diameter, apically a long, slender, finger-like process. Palpi yellowish; first segment rectangular, the second twice the length of the first, the third as long as the second, the fourth one half longer than the third. Mesonotum reddish brown, sparsely haired, submedian lines yellowish. Scutellum

and postscutellum fuscous yellowish. Abdomen a light fuscous yellowish orange. Costa fuscous straw. Ovipositor rather stout and when extended about half the length of the abdomen, the terminal lobes narrowly lanceolate, with a length nearly three times the width, rather thickly setose apically. Other characters about as in the male.

Reared from a narrow, clustered apical bud gall on *Spiraea salicifolia* collected by Miss Cora H. Clarke of Magnolia, Mass. Allied to *P. pratensis* Felt. Type C. a2074.

Cecidomyia cerasiphila n. sp. *Female.*—Length 2.5 mm. Antennæ black; fourteen segments, the fifth with a stem one fourth the subcylindric basal enlargement, which latter has a length twice its diameter, is slightly constricted near the middle and has sparse subbasal and subapical whorls of setæ; terminal segment somewhat produced, with a length two and one half times its diameter and tapering to an obtusely rounded apex. Face pale reddish yellow. Palpi pale reddish yellow; first segment irregularly subquadrate, the second stouter, with a length fully twice its diameter, the third a little longer, more slender, the fourth nearly twice the length of the third, greatly dilated. Mesonotum black, the submedian lines fuscous. Scutellum and postscutellum fuscous yellowish. Abdomen dark red. Wings hyaline, costa pale straw, the third vein uniting therewith well beyond the apex. Halteres reddish orange. Legs reddish yellow; the femora near the tip, and the two anterior pair of tibiæ and all of the tarsi dusky; claws stout, strongly curved, simple, the pulvilli longer than the claws. Ovipositor greatly produced, with a length fully one half greater than the body; terminal lobes slender, with a length six times their diameter, sparsely setose apically. Colors by Pergande.

Reared by Theodore Pergande from swollen fruits of wild cherry. Loaned for study by U. S. Bureau of Entomology. Type C. 879.

Cecidomyia hopkinsi n. sp. *Female.*—Length 1.5 mm. Antennæ light brown; fourteen segments, the fifth with a stem about three fourths the length of the subcylindric basal enlargement, which latter has a length fully twice its diameter, is slightly constricted near the basal third and has rather thick subbasal and subapical whorls of long, stout setæ; terminal segment with a length four times its diameter, tapering distally to a rounded apex. Palpi; first segment irregularly subquadrate, the second with a length fully three times its diameter, rather stout, the third short, more slender than the second and the fourth about as long as the third, dilated. Mesonotum reddish brown, the yellowish submedian lines rather thickly haired. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen rather thickly haired, reddish brown, darker laterally. Wings brownish, subhyaline, indistinctly spotted, there being indistinctly broken, transverse bands near the middle and at the distal fourth, the spot in each near the anterior margin, approximately at the middle and on the posterior margin; the third vein unites with the margin at the apex of the wing. Halteres pale yellowish, slightly fuscous subapically. Legs dark brown and annulate with yellowish as follows: A narrow band near the middle of femora; broad subbasal and subapical bands on tibiæ; narrow basal bands on the first and second tarsal segments; a broad band on the middle of the second tarsal segment and narrow indistinct ones basally on the third tarsal segment. Claws rather long, slender, evenly curved, simple, the pulvilli nearly as long as the claws. Ovipositor short, the terminal lobes broadly oval and sparsely setose.

Reared from Scolytid burrows in *Pinus attenuata* collected by Dr. A. D. Hopkins, at San Francisco, Cal. Loaned for study by the U. S. Bureau of Entomology. Type C. 988, 1004.

Itonida cucurbitae n. sp. *Male.*—Length 1 mm. Antennæ with fourteen segments, the fifth having the basal portion of the stem with a length twice its diameter, the distal part with a length three times its diameter; basal enlargement subglobose, the subbasal whorl rather thick, subapical circumfilum with loops extending to the base of the produced distal enlargement, which latter has a length one half greater than its diameter, a rather thick whorl of stout setæ and subbasal and subapical circumfili, the loops of the latter extending to the apex of the segment. Palpi probably quadriarticulate. Mesonotum yellowish brown, the submedian lines, scutellum and postscutellum fuscous yellowish. Abdomen yellowish brown, rather thickly clothed with yellowish hairs. Wings hyaline, costa light straw, the third vein uniting with the margin well beyond the apex. Halteres whitish transparent. Legs a light yellowish brown, the distal tarsal segments darker; claws rather long, stout, strongly curved, the pulvilli shorter than the claws. Genitalia; basal clasp segment short, strongly curved, truncate; terminal clasp segment long, slightly swollen basally; dorsal plate rather long, deeply and triangularly emarginate, the lobes broadly rounded; ventral plate rather long, broadly rounded; both plates sparsely setose. Harpes rather long, tapering, obtuse; style short, tapering to a subacute apex.

Female.—Length 1 mm. Antennæ light brown; fourteen segments, the fifth with the stem one fourth the length of the cylindric basal enlargement, which latter has a length about four times its diameter, is slightly constricted near the middle; subapical band scattering, the setæ strongly curved; terminal segment produced, the basal enlargement with a length five times its diameter; apically there is a long, finger-like appendage, the latter swollen basally. Palpi; first segment subquadrate, the second with a length three times its diameter, the third as long as the second, more slender, the fourth longer than the third. Ovipositor short, the terminal lobes narrowly oval and sparsely setose. Other characters practically as in the opposite sex.

Reared from orange larvae from a squash having a curious rough, fulvous appearance. Loaned for study by U. S. Bureau of Entomology. *Mycodiplosis cucurbitae* Felt was associated with this form. Type C. 966.

Itonida spiraeina n. sp. *Male.*—Length 1.5 mm. Antennæ dark brown, yellowish basally; fourteen segments, the fifth binodose, the basal portion of the stem with a length thrice its diameter, the distal part with a length four and one half times its diameter; the basal enlargement subglobose, the distal subcylindric, with a length one half greater than its diameter, the whorls of setæ long and stout; circumfili with the loops long, stout and rather sparse; terminal segment produced, the distal enlargement with a length three times its diameter and with a long, tapering apical process. Palpi fuscous yellowish; first segment irregular, fusiform, the second one half longer than the first, the third a little longer than the second, the fourth about as long as the third; face and mesonotum fuscous yellowish, the submedian lines yellowish, sparsely haired. Scutellum fuscous yellowish, setose apically; postscutellum yellowish white. Abdomen sparsely haired, fuscous yellowish, the insisures and pleuræ yellowish, the distal segments deep orange. Wings relatively broad,

costa dark brown, subcosta at the basal third, the third vein well beyond the apex. Halteres yellowish basally, fuscous apically. Coxæ fuscous yellowish. Legs fuscous straw, the distal tarsal segments darker; claws slender, evenly curved, simple, the pulvilli rudimentary. Genitalia fuscous, setose; basal clasp segment long, rather slender; terminal clasp segment long, slender; dorsal plate rather short, broad, triangularly emarginate, the lobes broadly and roundly emarginate, setose apically; ventral plate long, broad, deeply and roundly emarginate; style stout, broadly rounded apically.

Female.—Length 1.75 mm. Antennæ fuscous, whitish basally; fourteen segments, the fifth with a stem about three fourths the length of the cylindric basal enlargement, which latter has a length four times its diameter; subapical band scattering; terminal segment slightly produced, basal enlargement fusiform, with a length three times its diameter and apically with a long, slender, irregular appendage. Palpi; the first segment irregular, the second with a length four times its diameter, the third and fourth subequal, the latter dilated apically; face fuscous yellowish, the mouthparts apically deep carmine. Mesonotum fuscous yellowish, the submedian lines sparsely haired, yellowish. Scutellum and postscutellum fuscous yellowish. Abdomen light fuscous, the incisures and pleuræ fuscous yellowish, the distal segments with a reddish tinge. Halteres yellowish basally, fuscous apically. Coxæ fuscous yellowish, tarsi fuscous straw, the distal tarsal segments darker. Claws stout, strongly curved, simple, the pulvilli about half the length of the claws. Ovipositor yellowish, short, the terminal lobes with a length about four times the width, setose; minor lobes short, broad, setose.

Reared from bud galls, 3 mm. in diameter, on *Spiraea salicifolia* collected by Miss Cora H. Clarke at Magnolia, Mass. Allied to *I. apocyni* Felt. Type C. a1759x.

Itonida taxodii n. sp. *Male.*—Length 1.5 mm. Antennæ fuscous yellowish, the fifth segment having the basal part of the stem with a length one half greater than its diameter, the distal part with a length three times its diameter, the basal enlargement subglobose, the subbasal whorl moderately thick, stout, the circumfilum stout, the loops moderately long; the distal enlargement cylindric, with a length one half greater than its diameter, the whorl rather thick, the setæ stout and longer on one face; the loops of the distal circumfilum slightly produced on one face; terminal segment produced, the basal portion of the stem with a length three times its diameter, the distal enlargement constricted near the basal fourth and with a short, stout knob subapically. Palpi; first segment short, stout, the second broadly oval, the third a little longer, more slender, the fourth more than twice the length of the third. Mesonotum apparently fuscous, the submedian lines yellowish. Scutellum and postscutellum presumably a pale yellowish. The abdomen probably fuscous yellowish; genitalia presumably yellowish. Wings hyaline, costa pale straw, subcosta uniting therewith before the basal half, the third vein at the apex. Halteres yellowish. Legs apparently nearly a uniform yellowish, the claws strongly curved, slightly dilated subapically, the pulvilli distinctly shorter than the claws. Genitalia obscure in the preparation.

Female.—Length 2 mm. Antennæ light brown; fourteen segments, the fifth with a short stem one fifth the length of the cylindric basal enlargement, which latter has a length four times its diameter, is broadly constricted near the basal third; subbasal whorl sparse, stout, subapical whorl scattering, stout; rather distinct circumfili occur at the basal half and apically; terminal segment produced, with a

length five times its diameter, tapering from the distal fourth to the narrowly rounded apex. Palpi; first segment short, stout, the second one half longer, slender, the third one half longer than the second, more slender, the fourth a little longer and more slender than the third. Mesonotum reddish brown, the submedian lines fuscous yellowish, sparsely haired. Scutellum light yellowish brown, postscutellum yellowish brown. Abdomen rather dark yellowish brown. Halteres pale yellowish. Legs a nearly uniform reddish brown; claws strongly curved, distinctly swollen near the basal third, simple, the pulvilli rudimentary. Ovipositor nearly as long as the abdomen, the distal portion unusually stout; the lobes slender, with a length five times the width, narrowly rounded apically, minor lobes long, slender.

Reared from leaves of bald cypress, *Taxodium distichum* collected by Mr. H. G. Hubbard in Florida. Loaned for study by the U. S. Bureau of Entomology. Type C. 1038.

Itonida pugionis n. sp. *Male.* Length 1.75 mm. Antennæ one fourth longer than the body, rather thickly haired, the basal enlargements fuscous, the distal yellowish; fourteen segments, the fifth having the basal portion of the stem with a length twice its diameter, the distal part with a length two and one half times its diameter; terminal segment produced, the basal portion of the stem with a length nearly four times its diameter, the distal part cylindric, with a length fully three times its diameter and apically tapering suddenly to a narrowly rounded apex. Palpi; first segment subquadrate, the second with a length about twice the first, the third about as long as the second, more slender, the fourth slightly longer than the third and more slender, Mesonotum yellowish brown, slightly fuscous, the submedian lines thickly haired. Scutellum reddish orange, sparsely setose apically, postscutellum fuscous yellowish. Abdomen sparsely haired, a light fuscous orange, the pluræ rather thickly clothed with fuscous scales and appearing as a longitudinal broken, broad, fuscous stripe; venter fuscous yellowish, the sclerites somewhat darker. Wings distinctly yellow tinted, costa yellowish; near the center of the wing and at the apex of the reddish third vein, a distinct, black spot, a similar one, slightly produced, at the apex of the fifth vein, the fork of the latter and its branch covered by a dagger-like fuscous spot. Halteres yellowish orange, yellowish transparent apically. Coxæ fuscous; anterior and mid-femora mostly fuscous brown, the latter slightly yellowish apically, the posterior femora mostly yellowish; anterior tibiæ fuscous, the mid- and posterior tibiæ yellowish basally, fuscous apically, the first tarsal segment and the basal two thirds of the second fuscous, the distal third yellowish, the third and fourth tarsal segments yellowish orange, fuscous basally, the fifth reddish brown, somewhat fuscous basally. Claws rather slender, evenly curved, simple, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment long, rather slender; terminal clasp segment slightly swollen basally, long, slender; dorsal plate long, deeply and triangularly emarginate, the lobes tapering irregularly, rounded; ventral plate long, broad, narrowly rounded.

Female. Length 2.75 mm. Antennæ nearly as long as the body, sparsely light-haired, the enlargements dark brown, the stems whitish transparent, the stem of the fifth segment with a length equal to the subcylindric basal enlargement, which latter has a length two and one-half times its diameter, is strongly constricted near the middle and has, for a female, high subbasal and subapical circumfili, the loops stout and relatively broad; terminal segment subcylindric, produced, with a length four times its diameter, tapering apically to a narrowly rounded extremity. Coxæ fuscous yellowish; femora fuscous basally, yellowish apically; tibiæ yellowish basally,

fuscous apically, the first tarsal segment, the basal two thirds of the second, a narrow basal band on the third and fourth, and most of the fifth tarsal segments fuscous, the remainder yellowish. Ovipositor short, the terminal lobes narrowly lanceolate. Otherwise nearly as in the male.

Reared from jars containing chestnut and maple bark infested with numerous *Miastor americana* Felt larvæ. Type C. a2150 Y.

Itonida cincta n. sp. *Female.* Length 1.5 mm. Antennæ nearly as long as the body, sparsely haired, pale yellowish, the segments fuscous basally; fourteen segments, the fifth with a stem one third the length of the subcylindric basal enlargement, which latter has a length nearly three times its diameter; terminal segment produced, with a length six times its diameter, tapering to a subacute apex. Palpi; first segment short, stout, the second narrowly oval, with a length over twice its diameter, the third one half longer, more slender, the fourth one fourth longer than the third, more slender. Mesonotum yellowish brown. Scutellum and postscutellum pale yellow. Abdomen yellowish brown, the ovipositor orange red. Wings subhyaline, yellowish, distinctly marked with brown, there being a diffuse fuscous area near the basal fourth and extending to the posterior basal angle; another broad, diffuse band extends obliquely across the middle of the wing to the branching of the fifth vein; the apical fourth of the wing is mostly fuscous, except for an oval space near the distal ninth and close to costa, and a similar one midway between the third and fifth veins; an irregular though dark patch lies near the middle of the wing between the third and fifth veins. Legs banded, dark brown, the tibiæ with basal and subapical light bands, the posterior tarsi with first segment and the base of the second, third and fourth segments and all of the fifth yellowish white, the anterior tarsi with a broad band near the middle of the second and at the base of the third and fourth segments, the fifth silvery white. Ovipositor about as long as the abdomen, stout, the terminal lobes narrowly oval.

Reared from larvæ occurring under oak bark. Type C. 1074.

Itonida canadensis n. sp. *Male.* Length 1.5 mm. Antennæ one half longer than the body, rather thickly haired, light fuscous yellowish; fourteen segments, the fifth having the basal part of the stem with a length two and one half, the distal part, with a length three and one half times its diameter. Palpi; the first segment probably subquadrate, the second broadly oval, the third with a length about three times its diameter, the fourth one half longer than the third. Face whitish transparent. Thorax a nearly uniform yellowish transparent. Abdomen a variable pale yellowish, the basal and distal segments pale orange. Wings hyaline, yellowish; costa orange yellow, subcosta at the basal third, the third vein well beyond the apex. Halteres yellowish transparent. Coxæ pale yellowish; femora and tibiæ pale yellowish straw; tarsi mostly a very light brown, the distal segments somewhat darker; claws strongly curved basally, simple, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, slender, terminal clasp segment long; dorsal plate broad, deeply emarginate, the lobes produced laterally, roundly emarginate; ventral plate long, broad, broadly and roundly emarginate.

Female. Length 1.5 mm. Antennæ one third longer than the body, sparsely haired, pale yellowish; fourteen segments, the fifth with a transparent stem as long as the cylindric basal enlargement, which latter has a length slightly over twice its diameter; terminal segment produced, with a length three times its diameter and a long, finger-like apical process. Palpi; first segment short, stout, the second with

a length about three times its diameter, the third as long as the second, the fourth about one half longer than the third. Abdominal segments sparsely margined posteriorly with whitish hairs. Ovipositor short, the lobes slender, with a length thrice the width. Otherwise nearly as in the male.

Reared from a woolly, oval gall on the lateral veins of shadbush, Amelanchier, taken by Miss Cora H. Clarke at Magnolia, Mass. Type C. a1859.

TWO NEW APHIDS FROM CALIFORNIA[1]

By W. M DAVIDSON, *U. S. Bureau of Entomology, San José, Cal.*

So far as I can determine no plant louse has been reported from the California laurel (*Umbellularia californica* Nutt.) and so I will proceed to describe an aphid taken by me on this tree at San José, California, on July 1, 1911.

Hyadaphis umbellulariæ sp. nov.

Alate viviparous female.—Head, thorax, and abdomen green with a powdery white covering. Eyes crimson. Thoracic lobes and scutellum dark purplish-black; Head on the dorsum dark purple. Antennæ little over half the length of the body. joint III and the filament of about equal length. Comparative lengths of the joints as follows: I .09 mm., II .06 mm., III .39 mm., IV .26 mm., V .23 mm., VI .10 mm., filament .38 mm. Legs green and powdery like the body; femoral apices, tibial apices, and tarsi purplish-black. Tibiæ with two rows of spines, one on either side. Abdomen pale green with transverse white powdery bars. Cauda dusky, 0.14 mm. in length, narrow, tapering. Cornicles green, smaller than the cauda, in length 0.08 mm., broad at the base, then narrowing to two-thirds their maximum width at basal fourth, and thence widening distally so that their width at the apex equals twice that at the base. Wings large; veins pale brown, second fork of third discoidal a little nearer wing apex than first fork; stigma fairly long and narrow, green, as are also the insertions and sub-costal vein. The sensoria on the antennæ are disposed as follows: joint III has 25–30; joint IV 5–9; joint V 1 near the apex; joint VI, 1 terminal. Those on joint III are placed irregularly and are small, those on joint IV are in a single row and their size is similar to those in joint III. Beak short, reaching second coxæ, green with the extreme tip black. Mesosternum black.

Measurements of the body.—Length of body, 1.80 mm.; breadth of body, 0.65 mm.; wing expanse, 5.75 mm.

Taken on the underside of the leaves of California Laurel (*Umbellularia californica* Nutt.) July 1, 1911. Habitat: San José, California.

Cryptosiphum tahoense sp. nov.

Winged oviparous female.—Dark olive green, newly hatched specimens paler. Head, thoracic lobes and scutellum dark brown. Eyes dark red. Antennæ olive green, hardly one third as long as the body, on frontal tubercles. Ocelli distinct. Prothorax and abdomen olive green. Lateral tubercles absent. Abdomen with

[1] Published by permission of the Chief of the Bureau of Entomology.

seven or eight indistinct transverse brown bars. Cornicles very small, hardly more than a raised rim on surface of abdomen, dusky. Cauda rounded, short, with small hairs at edge. Legs olive green with distal two thirds of the femora and coxæ darker. Wings of moderate size, insertions and costa green. Stigma short, protruding into wing at the point where it is joined by the stigmatic vein. First two discoidals rather thick, brown, with their origins close together. Third discoidal with two branches, generally obsolete at its base, second fork equidistant from first fork and apex of the wing. The subcostal vein bends slightly into the wing at the point where it receives the two discoidal veins. Hind wings with two discoidals. Sternum black. Beak not reaching second coxæ, light green. About the first of September winged females began to develop. These contained from five to seven eggs in them at that time. Sensoria on antennæ as follows: joint III, 7–9; IV, V, VI, each with one apical sensorium. All sensoria are transverse.

Measurements.—Length of body, 1.8 mm.; breadth of body, .75 mm.; expanse of wings, 4.75 mm.; antennal joints I, .06; II, .04; III, .23; IV, .13; V, .12; VI, .11; VII, .04.

Pupa.—Olive green, younger individuals pale green and with the compound eyes not fully developed. Antennæ one fourth length of body, pale green. Legs pale green, coxæ and femora darker. Wing pads olive green. Cauda and cornicles as in the winged form. Abdomen on the dorsum with seven or eight transverse rows of small brown dots which apparently become the indefinite brown bars of the winged form. Beak very short, olive green.

Viviparous apterous female.—Before depositing young, greyish-brown, abdomen much distended, with considerable reddish mottling on the dorsum of abdomen and thorax, also with eleven transverse darker bars on dorsum of abdomen and dark areas on head and thorax. Cauda dark brown, rounded, short. Cornicles as in winged female. Antennæ very small, one eighth length of body, four-jointed, pale. Legs short, olive green. Abdomen on the under side with six short median transverse dark bars.

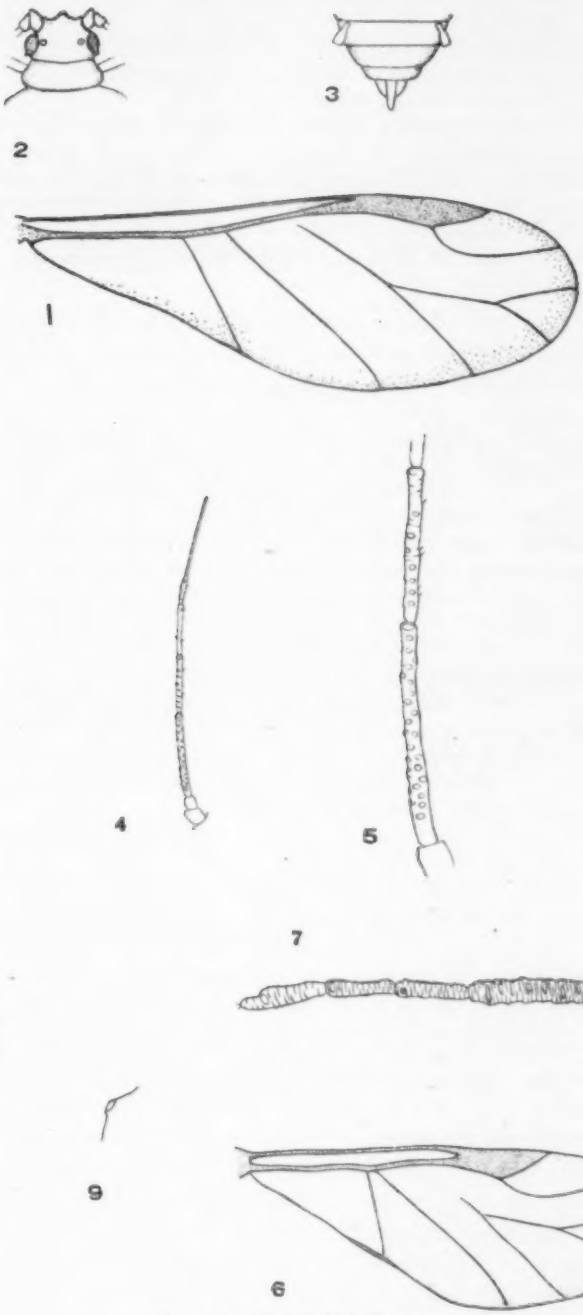
Measurements.—Length of body, 2.2 mm.; breadth of body, 1.22 mm.; antennal joints, I, .06; II, .04; III, .12; IV, .06.

Newly hatched young.—Very pale greenish white. Eyes red. A row of minute black spots down each side of the abdomen. Antennæ three-jointed.

This aphid occurs in galls on leaves and flower- or fruit-stalks on at least two species of manzanita (*Arctostaphylos pumilla* and *A. tomentosa*). The red galls show up very prominently on green leaves of the plant. These galls are of two kinds, one on the leaf, caused by the edge being turned over or the leaf being doubled in the middle and a pocket thus formed after the manner of *Pemphigus populimonilis* Riley, the other formed on the fruit stalk. The latter becomes bullet-shaped and in all the specimens examined contained only one apterous vivipara full of unborn young. In the leaf-galls in August were found only pupæ and occasionally the old shrunken, black stem-mother. On the last day of August the pupæ began to develop into winged forms, but as I left Lake Tahoe at this date, I could not ascertain how these migrated.

Taken at Lake Tahoe, California, in August, 1911, at an elevation of 6,200 feet.

Plate 23



New California Aphids

EXPLANATION OF PLATE 23

Hyadaphis umbellulariæ.—Fig. 1, wing.
Hyadaphis umbellulariæ.—Fig. 2, head and prothorax.
Hyadaphis umbellulariæ.—Fig. 3, caudal end of abdomen.
Hyadaphis umbellulariæ.—Fig. 4, antenna.
Hyadaphis umbellulariæ.—Fig. 5, antennal joints III, IV.
Cryptosiphum tahoense.—Fig. 6, wing.
Cryptosiphum tahoense.—Fig. 7, antenna of the winged female.
Cryptosiphum tahoense.—Fig. 8, antenna of the wingless female.
Cryptosiphum tahoense.—Fig. 9, cornicle of the winged female.
Figures 1–4, 6, magnified 60 diameters; figures 7–9, 150 diameters; figure 5, 160 diameters.

Scientific Note

The Cotton Moth in Connecticut.—I have read with interest the notes in *Science* October 13, page 488, by Prof. H. T. Fernald, and in *Entomological News* for November, page 415, by Dr. Henry Skinner, regarding the occurrence in large numbers of the Cotton Moth, *Alabama* (*Aletia*) *argillacea* Hubn., in the Northern States the latter part of September. In New Haven, Conn., the conditions were much the same as Doctor Skinner described them in Philadelphia. Hundreds of the moths were resting on the walls of the railroad station, and other buildings, especially near the water front, were literally covered. On September 25 I counted thirty of these moths inside a closed trolley car on Whitney Avenue on the way to my office. For several days afterward I noticed them scattered throughout the city, but growing fewer. One newspaper came out with an article stating that the Brown-tail Moth had reached the city in great numbers and threatened to do much damage. During a residence of seventeen years in New Haven I have never before observed or collected this insect, though our collection contains specimens taken in Waterbury by Mr. H. S. Woolley. Such a swarm is certainly unusual.

W. E. BRITTON.

JOURNAL OF ECONOMIC ENTOMOLOGY PUBLISHING CO.

The annual meeting of the stockholders of this Company will be held some time between December 27 and 29, in connection with the meeting of the Association of Economic Entomologists at Washington, D. C. The precise time and place will be announced at the sessions of that Association. Members of the advisory board are hereby notified that it devolves upon them to nominate the elective officers.

E. P. FELT, *President.*
E. DWIGHT SANDERSON, *Secretary.*

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

DECEMBER, 1911

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Reprints may be obtained at cost. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. The receipt of all papers will be acknowledged.—EDS.

The last few years have witnessed an earnest effort on the part of the officers of the association to make the most of our annual gatherings. The classification of the papers and the resultant partial limitation of the proceedings in any one session to the presentation of allied subjects, has been of great service in avoiding useless duplication in discussion and has tended toward a more comprehensive treatment of the problems under consideration. The recent introduction of symposial discussions was a most commendable step. A later idea, a tabulation of projects now in progress and the publication of that data early so each member may know of the undertakings of his associates, depends for efficiency upon general coöperation. Last year the report was prepared too late for publication in the December issue. This number, with the report of the committee, should reach most of our members several weeks before the meeting. There will then be an excellent opportunity to fully test this method of stimulating coöperation.

The government work has made Washington a most important scientific center and, as a consequence, the coming meeting will be one of our largest gatherings. We take part there in the proceedings of an assemblage representing the foremost exponents of economic entomology, not only in this country but abroad. Owing to the large number of active workers, rigid restrictions are necessary in the time allotted individual papers. It is perhaps unnecessary to add that there are too many new or unsettled problems to warrant the spending of much time on matters already well understood. There are on the program each year, an increasing number of technical papers which can be discussed intelligently by comparatively few. These conditions make timely the suggestion that authors arrange for one or more to open the discussion. It is easy to provide the party undertaking this, with a copy of the paper in advance. The resulting suggestions or criticisms will be immensely more valuable than the more or less impromptu discussions which have largely obtained in the past.

Reviews

Ticks, a Monograph of the Ixodoidea, by G. H. NUTTALL, CECIL WARBURTON, W. F. COOPER and L. E. ROBINSON, Cambridge University Press, Part II, Ixodidæ, pages XIX+105–348, May, 1911.

We are glad to announce the appearance of Part II of the above work, Part I of which was issued October 1908. Dr. G. H. F. Nuttall and Cecil Warburton appear as authors of this part. As a separate fascicle of this monograph, a very complete bibliography, compiled by G. H. F. Nuttall, L. E. Robinson and W. F. Cooper, has also recently been issued (July, 1911).

This monograph will be found indispensable to students of this group of animals. On the whole, Part II is rather an improvement on Part I of this work. The arrangement is well adapted to the working Entomologist and for the most part the species are well described and illustrated. This part is divided into two sections. Section I deals with the classification of ticks and Section II with the genus Ixodes. In the first section is given a good historical review of the classification of ticks. The authors adopt the classification proposed by Warburton in 1907 with the addition of the genus Rhipicentor, which was established by Nuttall and Warburton in 1908. The classification proposed appears to the writer to be more satisfactory than any other yet set forth. It is very similar to those classifications proposed by Banks and Dönitz. The discovery of a form (Rhipicentor) which is intermediate between Rhipicephalus and Dermacentor, as pointed out by the writers, would tend to favor grouping Dermacentor and Rhipicephalus close together rather than placing Dermacentor near Amblyomma, as suggested by Banks. The use of subfamily, tribal and group names which are not based upon the oldest genera included thereunder would seem open to criticism on account of not being in accord with the rules of zoölogical nomenclature. The authors have followed Dönitz in suppressing the genera Eschatocephalus, Ceratixodes and Neumanniella and in recognizing Margaropus and Boöphilus as distinct genera. The reëstablishment of the genus Boöphilus is undoubtedly correct; hence the Texas fever tick should receive the old mane *Boöphilus annulatus*. The genus Aponomma is considered a subgenus of Amblyomma. The generic diagnosis accompanied by figures illustrating the principal generic characters is a convenient arrangement. The author and date of establishment of each of the genera would in this connection have been a useful addition.

The first portion of Section II deals with the species of Ixodes systematically; the second portion (24 pages) presents some facts regarding the biologies of the group.

The definition of the terms used in description and classification of ticks will be found helpful, especially to those who are not thoroughly familiar with the terminology used in connection with ticks. The key presented for the separation of species of the genus Ixodes appears to have some minor objections, but on the whole it works satisfactorily. Complete synonomy, iconography and references to the literature appear under each species. The immature stages of several species are described and figured for the first time. The descriptions of both larvæ and nymph are inadequate in some cases. This may be largely excused, however, when we consider the difficulty of finding good characters to separate the species in these stages. It would appear that the authors have gone rather too far in the description of immature stages of ticks as belonging to certain species when they were simply collected with the adults of those species and not bred from determined females. As an illustration of the danger to be met with in considering all stages found on a host together as belonging

to the same species, it may be stated that frequently two and sometimes even three different species of Ixodes have been taken from the same host at the same time during investigations conducted by the Bureau of Entomology. The authors are correct, in my opinion, in placing *Ixodes scapularis* and *Ixodes californicus* as varieties of the European *ricinus*. There appears to be no valid reason for the maintenance of *Ixodes nigricans* as a distinct species rather than as a variety of *ricinus*. The material (one female from Death Valley, Calif.) considered by the authors to be *Ixodes pratti* Banks is undoubtedly *Ixodes kingi* Bishopp, as is clearly indicated by the description (of the female) and the illustration. This mistake was brought about by the inclusion by Mr. Banks of two distinct species [1] in the material considered *Ixodes pratti* by him. It might be stated here that Mr. Banks' description of the male of *Ixodes pratti* is based upon the male of *Ixodes ricinus* var. *scapularis*. Hence, the description of neither sex as given by Nuttall and Warburton applies to *Ixodes pratti*.

It is to be regretted that the authors did not have at hand a larger series of a number of the species discussed, to be used in the study of variation and correlation. Although in many of the species but very few or only single specimens have been collected, it would seem that larger series of other species might have been procured for study.

The authors consider that there are 51 valid species and 10 valid varieties and subspecies of Ixodes. Twenty-one species and two varieties are recorded from North America, this being a greater number than from any of the other continents. From this list, *Ixodes canisuga* should be stricken as it does not occur in North America. The authors misquote Mr. Banks on this point (page 214).

The greater portion of that part of the work dealing with biologies of Ixodes is devoted to *Ixodes ricinus*. Much of this matter is compiled from other authors. Brief biological notes (mostly compiled) relating to *Ixodes ricinus* var. *scapularis*, *Ixodes angustus*, *Ixodes pilosus*, *Ixodes canisuga* and *Ixodes pustus* are presented. The assemblage of these biological data will be found helpful particularly as they show how meager is the published information on Ixodes. This may tend to emphasize the need of more exhaustive and accurate investigations on the biologies of this interesting group.

As appendices are reprinted two papers previously published in Parasitology: "The Process of Copulation in *Ornithodoros moubata*" by Geo. H. F. Nuttall and Gordon Merriman and "On the Adaptation of Ticks to the Habits of their Hosts" by Geo. H. F. Nuttall.

F. C. BISHOPP.

The Importation into the United States of the Parasites of the Gipsy Moth and the Brown-Tail Moth: A Report of Progress, with some Consideration of Previous and Concurrent Efforts of this Kind, by L. O. HOWARD and W. F. FISKE, U. S. Dep't Agric., Bur. Ent., Bul. 91, pp. 1–312; plates 28 (several colored) and numerous figures, 1911.

The work with parasites of the gypsy and brown-tail moths has been continued for some six years and has already resulted in some most valuable contributions to knowledge and important modifications in laboratory practice. The above publication is a noteworthy paper on insect parasitism, based on an extended study of

[1] See Bishopp, "On Some New North American Ixodidæ with Notes on Other Species," Proc. Biol. Soc. Wash., Vol. XXIV, page 203.

the parasites of two introduced pests and subsidiary investigations of several native species. An examination of the bulletin shows it to be an important chapter in American entomology with ramifications extending to remote parts of the globe.

The senior author, in the introduction, gives a comprehensive and moderately detailed discussion of previous work in the practical handling of the natural enemies of injurious insects. Much of this is familiar to working entomologists though they will greatly appreciate the assemblage of this data, while for others it is almost essential to an understanding of the problem. The narrative detailing the progress of the work shows a well-planned development and gives an excellent idea of the complexity of the subject and the number of collaborators necessary. The investigation developed marked contrasts between the previous recorded parasites and the species actually reared from imported material. We now have as an outcome of these studies, an authentic list of the parasites and predaceous enemies of the gipsy and brown-tail moths, though no one unfamiliar with the subject has an adequate conception of the prolonged, careful investigations involved in ascertaining the relations of the various species to each other and their hosts. It was found not only necessary to study the parasites issuing from imported material, those attacking the hosts in America, but the work was wisely extended to include field observations upon the natural enemies of these insects in various European countries. The latter procedure proved necessary to a comprehensive understanding of the situation. The data secured abroad may prove invaluable when applied to solving the problems presented in America.

The summary shows that there have been introduced into this country, two egg parasites of the gipsy moth, one Hymenopterous and nine Tachinid parasites of gypsy moth caterpillars, four parasites of the pupæ and one predaceous beetle. The brown-tail moth has not been neglected, two egg parasites, four parasites of the smaller caterpillars, six of the larger caterpillars and three of the pupæ having been imported. The vast amount of material handled during this investigation is shown by the fact that over a million and a half of Hymenopterous parasites, over 63,000 Tachinid parasites and over 18,000 predatory beetles were imported from foreign countries. Each of the more important species, at least, has been the subject of careful investigations designed to ascertain all biological data which might be of service in the work of introducing and establishing these natural enemies. The series of maps show that a number of the imported forms have already attained a wide distribution, and lend much strength to the hope that in a few years the parasites may be of material service. An extended dissemination may be followed by rapid multiplication in the next few years with corresponding benefits. Those most familiar with the work look forward to a favorable outcome of this, the largest experiment in economic biology. The undertaking, while costly, is immensely cheaper than an unending and uneven struggle with hordes of voracious caterpillars strongly established over extensive areas and capable of subsisting upon a great variety of plants

The numerous excellent illustrations, together with the discussions of apparatus and methods, will prove of great service to the working entomologist. The several colored plates, while giving a fair idea of the characteristics of the insects delineated, do not, in our estimation, do justice to the original illustrations. Those responsible for the bulletin are to be congratulated upon having produced a work of such high grade and one destined to be a reliable guide for all subsequent efforts along such lines.

Current Notes

Conducted by the Associate Editor

In the Department of Entomology at the University of Kansas the following additions have recently been made:—Mr. H. B. Hungerford, A. B., University of Kansas, instructor in entomology. On the staff of the state entomologist, Mr. A. J. Spangle assistant state entomologist, and Mr. W. T. Emery, assistant entomologist, both graduates of the University of Kansas. A new research fellowship has just been established by the Board of Regents, and Mr. Roy Fraser, B. S., Toronto, has been elected to this fellowship. There are in the department this year nine candidates for advanced degrees.

According to *Canadian Entomologist*, Dr. C. Gordon Hewitt, Dominion entomologist of Canada, was married Wednesday, October 11, to Elizabeth, daughter of Sir Frederick and Lady Borden. Doctor Hewitt's many friends in the United States unite with those of Canada in "heartiest congratulations and all good wishes for the happiness of himself and his bride."

Dr. W. A. Riley, associate professor of entomology at Cornell University, gave a popular lecture on insects in connection with the dissemination of disease, at the recent meeting of the Ontario Entomological Society at Guelph, Ont.

C. P. Smith, assistant professor of botany at the Utah Agricultural College, and a member of this Association, has resigned his position and entered Cornell University as a graduate student in plant pathology. His address is 404 Union Avenue, Ithaca, N. Y.

According to the *Experiment Station Record*, the following changes have recently been made in the Entomological Department of the New Jersey Agricultural Experiment Station:—Raymond S. Patterson has been appointed assistant entomologist succeeding E. W. Stafford, resigned. E. L. Dickerson has also resigned as assistant to accept a position as instructor in the Newark High School.

On account of a change in political administration C. H. Baldwin became state entomologist of Indiana on November 1, *vice* B. S. Douglass.

Prof. A. L. Lovett, assistant entomologist of the Agricultural Experiment Station, Stillwater, Oklahoma, has resigned to become a member of the staff of Professor A. B. Cordley at Corvallis, Oregon. His place has been filled by the appointment of T. E. McElroy, who has previously been engaged in experimenting with insecticides on southern orchard pests in the employ of William Cooper and Nephews of Chicago. There still remains a vacancy in the department on account of the creation of a new position relative to state orchard inspection.

Professor Alexander D. MacGillivray has resigned his position at Cornell University to accept the assistant professorship of Systematic Entomology at the University of Illinois. The vacancy at Cornell has been filled by the appointment of Mr. J. Chester Bradley as assistant professor of Systematic Entomology.

Mr. J. R. Watson has been appointed entomologist of the Agricultural Experiment Station at Gainesville, Florida, vice Dr. E. W. Berger, who resigned a few months ago to become state nursery inspector.

According to *Science*, the following have been appointed associates in entomology of the Harvard University Museum for five years: Dr. William Barnes, Frederick Blanchard and Andrew Gray Weeks.

The degree of Doctor of Science was conferred on Dr. Henry Skinner by the University of Pittsburgh, Pa., on June 14, 1911. For some time Dr. Skinner has been curator of insects at the Academy of Natural Sciences, Philadelphia, Pa., and was for twenty-one years editor of *Entomological News*.

Mr. A. A. Girault, formerly assistant in entomology at Urbana, Ill., has accepted the appointment of Entomologist, Department of Agriculture, Queensland. His address is Brisbane, Australia.

According to *Science*, "Professor A. J. Cook, the veteran head of the department of biology at Pomona College, Claremont, California, has been appointed by Governor Johnson horticultural commissioner of California. He succeeds Mr. J. W. Jeffrey, who has held the office for seven years. Professor Cook was for many years prior to 1891 connected with the Michigan Agricultural College. He has written a number of books about horticultural subjects and is the author of a manual of apiculture. The position to which he has just been appointed is one of great importance, especially on account of the quarantine measures permissible under the California law, which look toward the prevention of the importation of new insect pests and plant diseases."

Rev. Henry C. McCook, D.D., a well-known Presbyterian clergyman of Philadelphia, and the author of a number of books and popular scientific articles on entomology, died in November at the age of seventy-four years.

Professor R. I. Smith, of the North Carolina College of Agriculture, we learn from *Science*, has accepted a position with the Porto Rico College of Agriculture, taking up extension work in agricultural education. His address after January 1, 1912, will be Mayaguez, Porto Rico.

A recent change in the New Hampshire laws for the control of the gipsy and brown-tail moths has resulted in Governor Bass appointing Professor W. C. O'Kane as state agent in charge of the work, in addition to his duties in the New Hampshire College and Agricultural Experiment Station. Colonel Dearborn, the previous incumbent, retired from office December 4th.

All readers of the JOURNAL will regret to learn that Professor John B. Smith, State Entomologist of New Jersey and Entomologist of the Agricultural Experiment Station, is seriously ill at his home in New Brunswick, N. J., and they will hope for his speedy recovery.

Mailed December 1, 1911.

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ERRATA

Page 239, line 17, for *contharis*, read *cantharsi*.
Page 354, line 24, for *prenolepsis*, read *prenolepis*.
Page 381, line 17, for *pastinacea*, read *pastinacæ*.
Page 381, line 30, for *fruit-*, read *fruiti-*.

TWENTY-FOURTH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

Washington, D. C., December 27–29, 1911

The twenty-fourth annual meeting of the American Association of Economic Entomologists will be held in Washington, D. C., December 27–29, 1911. The opening session will be called to order at 1.30 p. m., Wednesday, December 27. The meeting will be continued on Thursday in the morning and afternoon and the final session will be held at 10.00 a. m., Friday, December 29.

The meetings of this Association will be held in the New National Museum in rooms near the Division of Insects.

Other Meetings

The American Association for the Advancement of Science and its affiliated societies will hold meetings throughout the week.

The Entomological Society of America will meet on Tuesday, December 26 and on Wednesday morning. The public lecture before that society will be given Wednesday evening.

The American Association of Official Horticultural Inspectors will meet Thursday evening at 8 p. m., and the meeting will be continued on Friday afternoon and evening.

Hotel Headquarters

Hotel headquarters for this Association have been secured at the Ebbitt House, corner of 14th and F Street, N. W. This hotel is centrally located and is within easy reach of the place of meeting and points of interest. Rates, $1.50 to $4.00 a day on the European plan and $3.00 a day on the American plan.

Members are urged to secure hotel reservations as far in advance as possible, as this will be to the advantage of all concerned.

Railroad Rates

The following information concerning railroad rates has been furnished by Dr. L. O. Howard, permanent secretary, American Association for the Advancement of Science:

A railroad rate of one fare and three-fifths for the round trip, on the certificate plan, has been granted by the Trunk Line Association, the Eastern Canadian and the New England Passenger Associations (not including the Bangor and Aroostock R. R. and the Eastern and the Metropolitan Steamship Companies).

The Southwestern Passenger Association offers no special rate, but advises members to take advantage of the "Christmas Holiday Excursion Rates," the dates of sale being December 15, 16, 17 and 21 to 25, inclusive, with final return date of January 8, 1912.

From the States of California, Nevada, Oregon, Washington and west of, including, Mission Junction, B. C.; also from what are known as Kootenay common points, namely, Nelson, Rossland, Sandon, Kaslo and Grand Forks, B. C., the Transcontinental Passenger Association has on sale daily Nine Months' Tourists' fares, approximating two cents per mile in each direction, or about one fare and one-third for the round trip. The nine months' fares apply to the eastern gateways of the Transcontinental territory, and station agents will cheerfully advise delegates as to the eastern points to which it will be most advantageous for them to purchase nine months' tickets in rebuying through to Washington.

The following directions are submitted for the guidance of members traveling on the Certificate Plan from the territories of the *Trunk Line Association* and the *New England* and the *Eastern Canadian Passenger Associations:*

1. Tickets at full fare for the *going* journey may be secured within three days (exclusive of Sunday) prior to, and during the first three days of the meeting. The advertised dates of the meeting are December 26 to December 30, 1911, consequently, you can obtain your tickets not earlier than December 22, 1911, and not later than December 28, 1911.

From points located at a great distance, from which it takes more than three days to reach Washington, going tickets may be purchased on a date which will permit members to reach Washington by December 26, 1911.

2. Present yourself at the railroad station for ticket and certificate at least thirty minutes before departure of the train.

3. Certificates are not kept at all stations. If you inquire at your station you will find out whether certificates and through tickets can be obtained to the place of meeting. If not obtainable at your home station, your agent will inform you at what station they can be obtained. You can in such case purchase a local ticket thence, and there purchase through ticket and secure certificate to place of meeting. Be sure that, when purchasing your going ticket, you request *a certificate. Do not make the mistake of asking for a receipt.*

4. On your arrival at the meeting, present your certificate to Mr. F. S. Hazard, assistant secretary. It has been arranged that the special agent of the Trunk Line Association will be in attendance at the office of the Permanent Secretary, New Willard Hotel, to validate certificates daily (9 a. m. to 6 p. m.) from Wednesday to Saturday, December 27 to 30, 1911, both dates inclusive. *A fee of 25 cents will be charged at the meeting for each certificate validated.* If you arrive at the meeting and leave for home prior to the special agent's arrival, or if you arrive at the meeting later than December 30, after the special agent has left, you cannot have your certificate validated and consequently you will not get the benefit of the reduction on the home journey. *No refund of fare will be made on account of failure to have certificate validated.*

If the necessary minimum is in attendance, and your certificate is duly validated, you will be entitled, up to and including January 3, 1912, to a continuous passage ticket to your destination via the route over which you made the going journey, at three-fifths of the limited fare.

Announcement Concerning Dues

Each member attending the meeting on payment of all dues, including those for 1912, will be supplied with the official button of the Association, which will be furnished by the secretary.

PROGRAM

Wednesday, December 27, 1.30 p. m.

Report of the secretary.

Report of the executive committee, by President Washburn.

Report of the committee on nomenclature, by Herbert Osborn, chairman, Columbus, Ohio.

Report of the committee on testing proprietary insecticides, by E. D. Sanderson, chairman, Morgantown, W. Va.

Report of the committee on affiliation with agricultural organizations, by Lawrence Bruner, chairman, Lincoln, Neb.

Report of the committee on legislation, by T. B. Symons, chairman, College Park, Md.

Report of the committee on affiliation of the Horticultural Inspectors with the American Association of Economic Entomologists, by T. B. Symons, chairman, College Park, Md.

Report of the committee on entomological investigations, by E. D. Sanderson, chairman, Morgantown, W. Va.

Report of the committee on employment bureau for entomologists, by President Washburn, chairman.

Appointment of committees.

Miscellaneous business.

Action on the proposed amendment to article 3 of the By-laws so that section 1 will read as follows: "The annual dues of active members shall be $2.00 and of associate members, $1.50, which shall be payable in advance, the same to include a subscription to the JOURNAL OF ECONOMIC ENTOMOLOGY. No dues shall be payable from foreign members but they shall be charged $1.50 for the JOURNAL if they desire it."

New business.

Annual address of the president, F. L. Washburn, St. Anthony Park, Minn.

Reading of Papers

"Methods in Photographing Insects," by W. C. O'Kane, Durham, N. H. Lantern. (12 minutes.)

"Pellagra and the Sand Fly," by S. J. Hunter, Lawrence, Kan. (15 minutes.)

A series of experiments and investigations to determine what part, if any, this insect plays in the transmission of Pellagra.

"Some Problems of Mosquito Control in the Tropics," by Allan H. Jennings, Washington, D. C. (15 minutes.)

Adjournment.

Program

Thursday, December 28, 10 a. m.

Reading of Papers

"The Date when Wheat Should be Sown to Escape the Fall Brood of Hessian Fly," by T. J. Headlee, Manhattan, Kan. (10 minutes.)

A brief discussion of the factors which determine this date in the light of three years' experimental tests.

"The Corn Bill Bug (*Sphenophorus callosus*)," by R. I. Smith, West Raleigh, N. C. (15 minutes.)

A biological study of this insect, including records of egg-laying, hatching, rearing, etc.

Discussion to be led by F. M. Webster, Washington, D. C.

"Wire Worms in Corn and Potatoes," by O. A. Johannsen, Orono, Me. (5 minutes.)

A summary of the work done at Highmore Farm, Maine, with poisons and repellants and a discussion of crop rotation with a view of obtaining suggestions for continued experiments.

"Grasshopper Work in Minnesota for the Season of 1911," by F. L. Washburn, St. Anthony Park, Minn. (12 minutes.)

Brief review of conditions, experiments and remedial measures employed.

Discussion to be led by Lawrence Bruner, Lincoln, Neb., and C. P. Gillette, Fort Collins, Colo.

"The Outbreak of *Alabama argillacea* Hbn. in 1911," by W. D. Hunter, Dallas, Texas. (10 minutes.)

A brief description of the very unusual outbreak in 1911 and its probable causes.

"The Work in Peru Against the White Scale of Cotton," by C. H. T. Townsend, Piura, Peru. (15 minutes.)

Outline of the parasites so far used and their shortcomings due to the particular conditions here present, with plans of the work for the future.

"The Cotton Square-weevil of Peru and its Parasites," by C. H. T. Townsend, Piura, Peru. (15 minutes.)

Additional data on the weevil, with an enumeration of the parasites reared from infested squares and bolls to date.

"Natural Control of Aleyrodid Pests of Citrus in Florida," by E. A. Back, Blacksburg, Va. (15 minutes.)

Results of Experiments conducted by U. S. Bureau of Entomology.

Adjournment.

Program

Thursday, December 28, 1.30 p. m.

Reading of Papers

"Insecticides for Use in Controlling the White Fly," by W. W. Yothers, Orlando, Fla. (15 minutes.)

Discusses the successful use of insecticides against this pest.

"Ortho-Arsenite of Zinc as an Insecticide," by R. A. Cooley, Bozeman, Mont. (10 minutes.)

A comparison of this insecticide with Paris green and arsenate of lead with respect to (*a*) injury to the bark of the apple, (*b*) settling in water with and without soap, (*c*) killing power and (*d*) cost. The results indicate a promising insecticide.

"Some Results of Lime-Sulfur Research in Oregon," by A. B. Cordley, Corvallis, Ore. (15 minutes.)

Discussion to be led by P. J. Parrott, Geneva, N. Y.

"The Susceptibility of Adults and Eggs of Pear Psylla to Spraying Mixtures," by P. J. Parrott and H. E. Hodgkiss, Geneva, N. Y. (To be read by title.)

Discussion of a large number of experiments to determine the effects of various sprays on adults, eggs and nymphs.

"The Efficiency of the Driving Spray for the Codling Moth," by E. D. Ball, Logan, Utah. (15 minutes.)

Results of extensive tests, with a general discussion of the methods of determining the actual and comparative efficiency of a given spray.

"Recent Experiments with the Codling Moth," by E. P. Felt, Albany, N. Y. (10 minutes.)

Brief discussion of the results obtained by spraying this year in comparison with those of the two preceding seasons.

Discussion to be led by A. L. Quaintance, Washington, D. C.

"A Third Brood of the Codling Moth in Kansas," by L. M. Peairs, Manhattan, Kan. (10 minutes.)

Evidence from the season's work in Kansas orchards shows a large third brood of this moth.

"Spread of the Leopard Moth in Connecticut and its Injury to Shade Trees," by W. E. Britton, New Haven, Conn. (10 minutes.)

Brief account of its spread and notes on injury to the different kinds of trees.

"Notes on the Control of Three Shade Tree Pests," by Glenn W. Herrick, Ithaca, N. Y. (10 minutes.)

"Some Shade Tree Pests in Eastern Massachusetts," by A. F. Burgess, Melrose Highlands, Mass. (15 minutes.)

"Progress in Exterminating Two Isolated Gypsy Moth Colonies in Connecticut," by W. E. Britton, New Haven, Conn. (10 minutes.)

Brief account with figures showing time, force and funds used to produce the results obtained.

Adjournment.

Program

Friday, December 29, 10 a. m.

Reading of Papers

"The Gooseberry Gall Midge or Bud Deformer (*Rhopalomyia grossulariæ* Felt)," by J. S. Houser, Wooster, Ohio. (12 minutes.)

Brief notes concerning occurrence and life history.

"Occurrence of the Pear Thrips in New York," by P. J. Parrott, Geneva, N. Y. (15 minutes.)

Circumstances of discovery, distribution and spray experiments.

"Some Experiments to Determine the Effects of Roentgen Rays on Insects," by W. D. Hunter, Dallas, Texas. (10 minutes.)

Deals largely with tests to determine the sterilizing effects of the rays.

"Insects of the Year in Massachusetts," by H. T. Fernald, Amherst, Mass. (5 minutes.)

"The More Important Injurious Insects in 1911 in Nebraska," by Myron H. Swenk, Lincoln, Neb. (5 minutes.)

"Insects Especially Injurious in Virginia during 1911," by E. A. Back, Blacksburg, Va. (5 minutes.)

"Injurious Insects in 1911 at Treesbank, Manitoba," by Norman Criddle, Treesbank, Manitoba, Canada. (10 minutes.)

Final Business Session

Report of committee on auditing.
Report of committee on resolutions.
Report of committee on memorial resolutions.
Report of committee on membership.
Report of other committees.
Report of committee on nominations.
Election of officers.
Miscellaneous business.
Fixing the time and place of the next meeting.
Final adjournment.

A. F. BURGESS, *Secretary*,
Melrose Highlands, Mass.

F. L. WASHBURN, *President*,
St. Anthony Park, Minn.

PRELIMINARY PROGRAM OF THE TENTH ANNUAL MEETING AMERICAN ASSOCIATION OF OFFICIAL HORTICULTURAL INSPECTORS

Washington, D. C., December 28 and 29, 1911

First Session—Thursday 8 p. m.

Organization.

Report of Secretary, T. B. Symons, College Park, Md.

President's Annual Address, Franklin B. Sherman, Raleigh, N. C.

"What Should the State Require of a Neglectful Owner of a Dangerous Orchard," Dr. S. A. Forbes, Urbana, Ill.

Report of Committee on National Legislation, T. B. Symons, Chairman.

Miscellaneous Business.

Second Session—Friday 1 p. m.

"Exempting Certain Species of Plants from Fumigation for San José Scale," S. A. Green, Urbana, Ill.

"Enforcing Fumigation and the Attitude of Nurserymen and Growers to the Treatment," T. B. Symons, College Park, Md.

"The Chestnut Bark Disease." Dr. Haven Metcalf, U. S. Dept. of Agriculture.

"The Stopping Back of Peach Trees Due to Bud Mites," H. A. Surface, Harrisburg, Pa.

"Dangerous Foreign Diseases Liable To Be Imported on Plants," Dr. Perley Spaulding, U. S. Dept. of Agriculture.

Discussion.

Third Session—8 p. m.

"The Present Status of Crown Gall," J. B. S. Norton, College Park, Md.

"Recent Importations of Dangerous Foreign Insect Pests," C. L. Marlatt, U. S. Dept. of Agriculture.

"A Recent Decision of the Supreme Court of Kansas," S. J. Hunter, Lawrence, Kan.

Questions for Discussion

1. Is it desirable that the inspection laws and service of a state should be made to include the quality and variety of nursery stock, in a way to insure the purchaser so far as practicable against fraudulent transactions or exorbitant prices?

2. What is the best general practice to follow in orchard inspection work?

3. *a*—What ought to be the attitude of inspectors towards nursery stock brought into a state or sections of a state that are free from gipsy moth?

   b—Same, relative to brown tail moth?

   c—What should be the attitude of inspectors relative to nursery stock slightly infested with scale that is planted in areas of a general infestation.

   d—What should inspectors do to prevent the spread and distribution of chestnut bark disease?

4. Some problems in connection with the interstate commerce law.

A complete program will be mailed to all members of this Association. It is hoped that the horticultural inspectors of the country will plan to attend this meeting as there are many very important questions requiring our united action.

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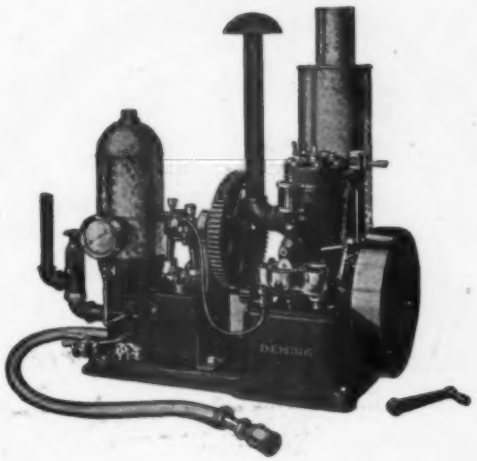

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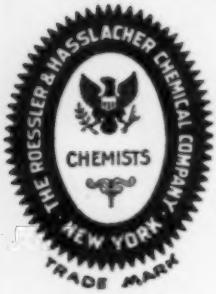

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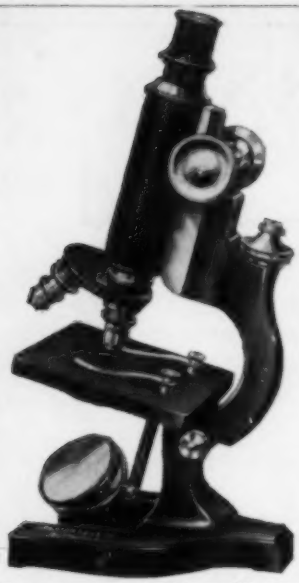

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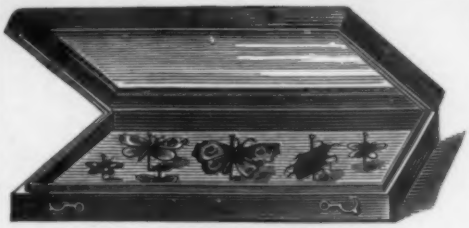

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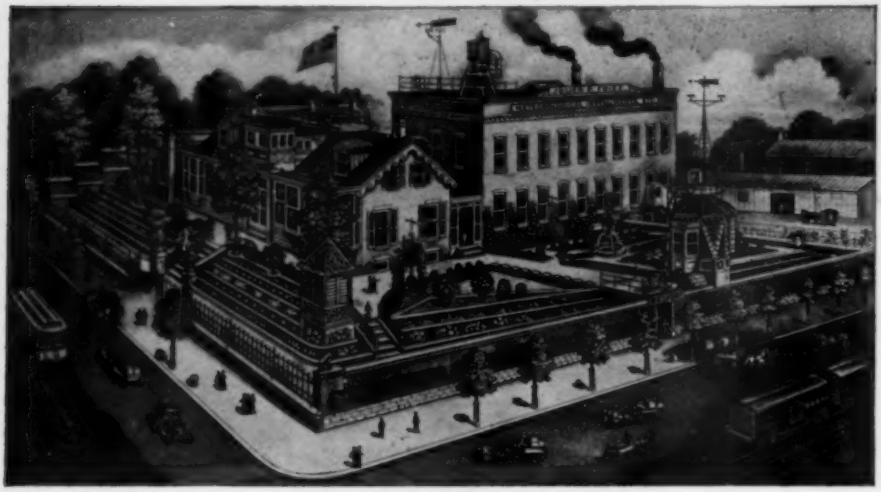

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